DOCUMENT RESUME

ED 216 124 CE 032 077

AUTHOR	Butler, Raymond H.; And Others
TITLE	Industrial Maintenance, Volume III. Post Secondary Curriculum Guide.
INSTITUTION	Georgia Univ., Athens. Div. of Vocational Education.
SPONS AGENCY	Georgia State Dept. of Education, Atlanta. Office of Adult and Vocational Education.
PUB DATE	81
NOTE	332p.; For related documents see CE 032 074-076.
EDRS PRICE	MF01/PC14 Plus Postage.
DESCRIPTORS	Air Conditioning; Behavioral Objectives; Carpentry; Course Descriptions; Electrical Systems; *Equipment Maintenance; Facility Guidelines; Heating; *Industry; Learning Activities; *Machine Repairers; Machine Tools; Machinists; Postsecondary Education; *Repair; State Curriculum Guides; *Trade and Industrial Education; Welding
IDENTIFIERS	Georgia

ABSTRACT

This volume is the fourth of four volumes that comprise a curriculum guide for a postsecondary industrial maintenance program. It contains three sections and appendixes. Section 4 provides suggested methods of structuring the curriculum. Suggested ways of recording and documenting student progress are presented in section 5. Section 6 contains facility layouts. Appendixes include an instructional resource matrix, unit guide references, additional instructional resources, resource addresses, information on working with special needs students, and definitions of terms. (YLB)

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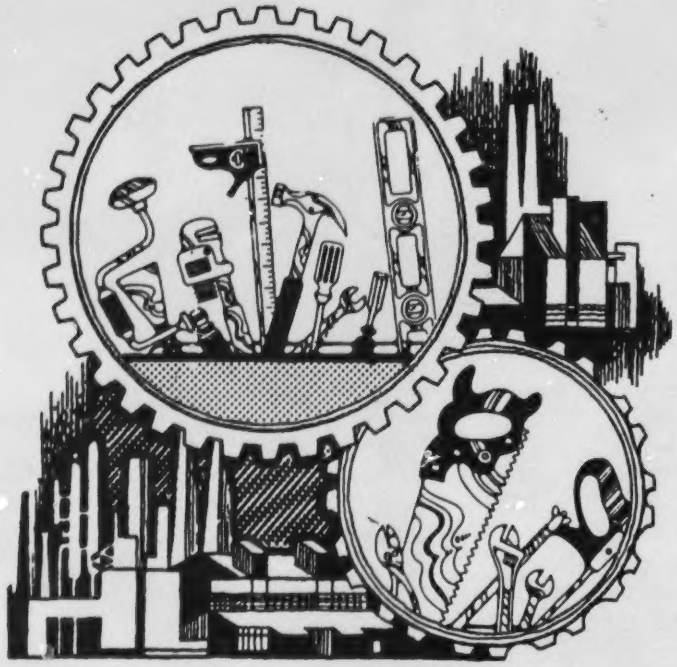
INDUSTRIAL MAINTENANCE

Post Secondary



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VOLUME III

CURRICULUM GUIDE

CE 032 077

Georgia Department of Education

INDUSTRIAL MAINTENANCE

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

INDUSTRIAL MAINTENANCE

VOLUME III

Developed By

The University of Georgia

Under the Direction of

Dr. Paul Scott

Vocational Education Materials Center

Division of Vocational Education

College of Education

Dr. George L. O'Kelley, Jr.

Division Chairman

INDUSTRIAL MAINTENANCE - VOLUME III

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SECTION IV

CURRICULUM STRUCTURE, EXIT POINTS & COURSE OUTLINE

SECTION IV

Section IV Content List

Introduction to the Curriculum Structure
Curriculum Structure
  Group
  Individualized
Introduction to Industrial Maintenance Exit Points
Introduction to the Course Outline
Course Outline

Section III presented a sample organizational model for sequencing the instruction of program tasks. Based on that model, Section IV provides suggested methods of structuring the entire Industrial Maintenance curriculum.

INTRODUCTION TO THE CURRICULUM STRUCTURE

A curriculum structure is developed by sequencing duties into a logical teaching plan. Two curriculum structures are presented in this section - group and individualized.

The individualized structure also lists the duty areas, but does not include hours or quarters. Using the individualized approach, the student proceeds at his or her pace until each task is mastered.

In either type of structure, the duty areas can be rearranged to meet local needs.

INDUSTRIAL MAINTENANCE SUGGESTED CURRICULUM STRUCTURE*

Course	Class Hours	Lab Hours	Total Hours
Quarter I			
Industrial Process and Maintenance I	110	126	236
Related Instruction	0	76	76
	110	202	312
Quarter II			
Industrial Process and Maintenance I	204	104	308
Related Instruction	0	4	4
	204	108	312
Quarter III			
Industrial Process and Maintenance I	110	102	212
Related Instruction	0	100	100
	110	202	312
Quarter IV			
Electrical Maintenance	200	85	285
Related Instruction	0	27	27
	200	112	312
Quarter V			
Electrical Maintenance	144	144	288
Related Instruction	0	24	24
	144	168	312
Quarter VI			
Electrical Maintenance	108	107	215
Related Instruction	0	97	97
	108	204	312
Quarter VII			
Machine Shop	135	151	286
Related Instruction	0	26	26
	135	177	312

Course	Class Hours	Lab Hours	Total Hours
Quarter VIII			
Machine Shop	63	111	174
Related Instruction	0	138	138
	63	249	312
Total Program Hours	1074	1422	2496

---

*This curriculum structure is designed to be used for group instruction.

OPTIONAL INDUSTRIAL MAINTENANCE SUGGESTED CURRICULUM STRUCTURE*

Course	Class Hours	Lab Hours	Total Hours
Quarter I			
Welding	120	183	303
Related Instruction	0	9	9
	120	192	312
Quarter II			
Welding	91	191	192
Related Instruction	0	30	30
	91	221	312
Quarter III			
Air Conditioning and Heating Maintenance	127	113	240
Related Instruction	0	72	72
	127	185	312
Quarter IV			
Heating	166	110	276
Related Instruction	0	36	36
	166	146	312
Quarter V			
Sheet Metal	52	34	86
Related Instruction	0	226	226
	52	260	312
Quarter VI			
Vehicle Maintenance	110	67	177
Related Instruction	0	135	135
	110	202	312
Quarter VII			
Carpentry	65	74	139
Related Instruction	0	173	173
	65	247	312
Total Program Hours	731	1453	2184

*This curriculum structure is designed to be used for group instruction.

INDUSTRIAL MAINTENANCE SUGGESTED CURRICULUM STRUCTURE*

ORIENTATION:
- School Policies and Procedures
- Program Orientation and Safety
- Operation of Audiovisual Equipment
- Using the Learning Resource Center

CURRICULUM AREAS:
- Industrial Process and Maintenance I
- Electrical Maintenance
- Machine Shop

---

*This curriculum structure is designed to be used for individualized instruction.

OPTIONAL INDUSTRIAL MAINTENANCE SUGGESTED CURRICULUM STRUCTURE*

ORIENTATION:
- School Policies and Procedures
- Program Orientation and Safety
- Operation of Audiovisual Equipment
- Using the Learning Resource Center

CURRICULUM AREAS:
- Welding
- Air Conditioning and Heating Maintenance
- Heating
- Sheet Metal
- Vehicle Maintenance
- Carpentry

---

*This curriculum structure is designed to be used for individualized instruction.

INTRODUCTION TO INDUSTRIAL MAINTENANCE
EXIT POINTS

The following diagrams illustrate points in the Industrial Maintenance program where a student should have acquired competencies necessary for entry level employment.

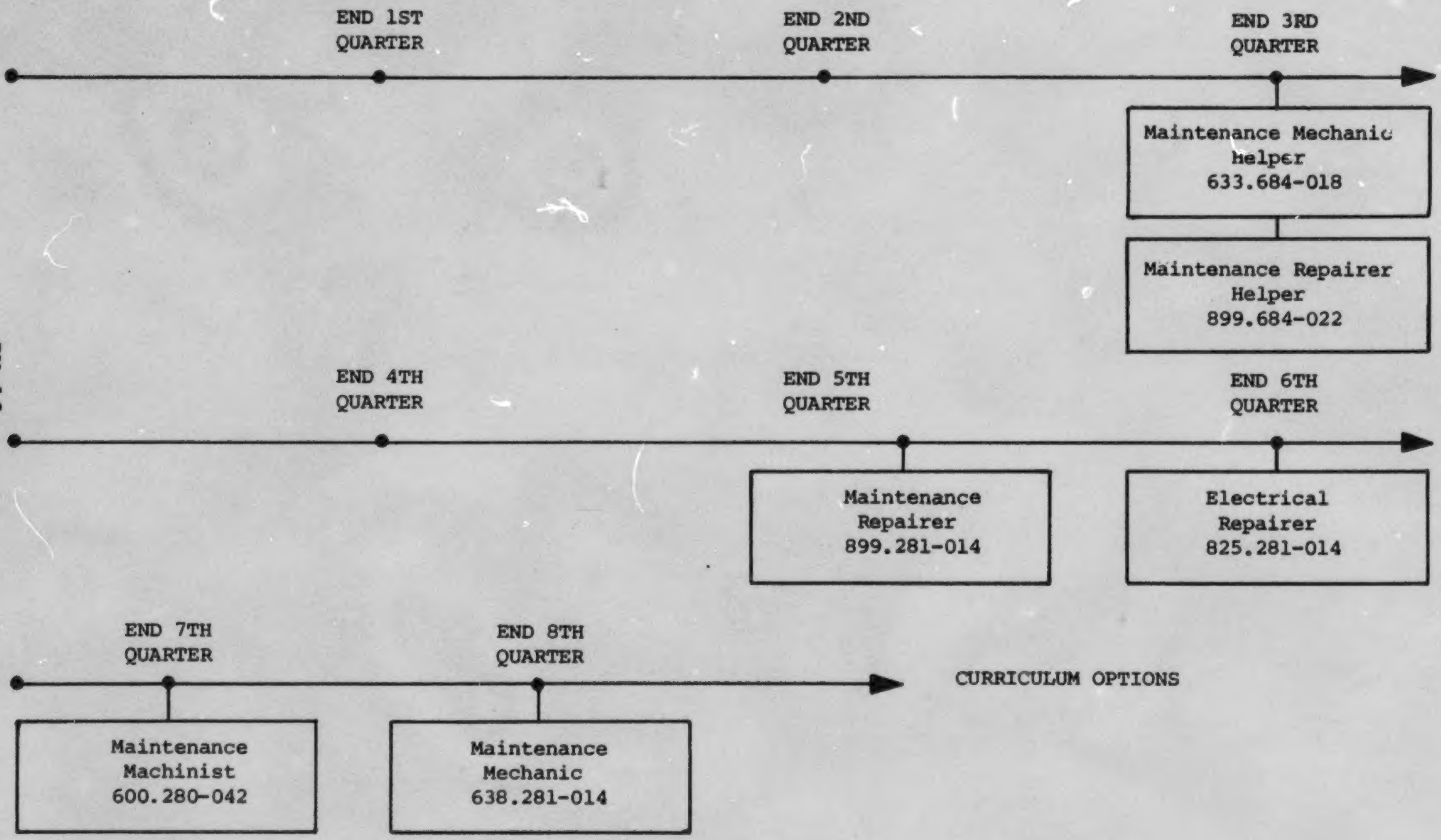
Both the group and individualized exit point diagrams sequence the Industrial Maintenance job classifications from least to most difficult. The group exit point diagram illustrates a lock-step process in which students proceed through an entire program at the same pace and exit at approximately the same point in time.

The individualized exit point diagram illustrates a self-paced progression through the Industrial Maintenance program. This approach permits a student to complete any one or all tasks necessary for entry level employment.

The major difference between the group and individualized approach is the number of tasks a student must master. For example, in the individualized approach, a student desiring employment as a Maintenance Repairer needs to complete only those tasks identified for that job. However, in the group approach, a student must master the tasks in the previous DOT classifications leading to that particular job title.

Both diagrams are based on the preceeding suggested curriculum structures.

INDUSTRIAL MAINTENANCE
(GROUP INSTRUCTION)


END 1ST QUARTER
END 2ND QUARTER
END 3RD QUARTER
Maintenance Mechanic Helper 633.684-018
Maintenance Repairer Helper 899.684-022
END 4TH QUARTER
END 5TH QUARTER
END 6TH QUARTER
Maintenance Repairer 899.281-014
Electrical Repairer 825.281-014
END 7TH QUARTER
END 8TH QUARTER
CURRICULUM OPTIONS
Maintenance Machinist 600.280-042
Maintenance Mechanic 638.281-014

INDUSTRIAL MAINTENANCE
(INDIVIDUALIZED INSTRUCTION)

Maintenance Mechanic
Helper
633.684-018

Maintenance Repairer
Helper
899.684-022

Maintenance
Repairer
899.281-014

Electrical
Repairer
825.281-014

Maintenance
Machinist
600.280-042

Maintenance
Mechanic
638.281-014

INTRODUCTION TO THE COURSE OUTLINE

A course outline suggests a method of sequencing tasks for instruction. In the following outline, the unit guide tasks are ordered according to duty areas. The tasks are then arranged from general to specific knowledge and applications. The instructor is not restricted to using this specific outline, but may adapt it to meet his or her teaching needs.

The following course outline is designed for group instruction, however, it may be adapted for individualized instruction by eliminating the time sequencing for tasks.

INDUSTRIAL MAINTENANCE COURSE OUTLINE

Quarter I

Task	Title	Class Hours	Lab Hours
	DUTY I: INDUSTRIAL PROCESS AND MAINTENANCE		
IPM-01	Identifying basic principles of blueprint reading	3	2
IPM-02	Identifying elements of machine drawings	3	2
IPM-03	Identifying hydraulic and pneumatic drawings	3	2
IPM-04	Using machine drawings in the maintenance of machinery and equipment	5	15
IPM-05	Reading building drawings	3	2
IPM-06	Reading electrical drawings	3	2
IPM-07	Reading pipe system drawings	2	2
IPM-08	Reading sheet metal drawings	3	2
IPM-09	Using shop math to interpret blueprints	5	15
IPM-10	Sketching schematic diagrams	5	5
IPM-11	Identifying types of schematics used in plant engineering	5	10
IPM-12	Identifying the symbols on electrical, piping and fluid power diagrams	10	20
IPM-13	Identifying guidelines for reading schematics	3	2
IPM-14	Identifying electrical symbols	3	2
IPM-15	Reading electrical diagrams	5	5
IPM-16	Identifying piping symbols	3	2
IPM-17	Reading piping schematics	5	5
IPM-18	Identifying fluid power symbols	3	2
IPM-19	Reading fluid power schematics	3	2
IPM-20	Identifying welding symbols	4	2
IPM-21	Identifying and using basic measuring tools	4	2
IPM-22	Identifying and using wrenches and screwdrivers	3	3
IPM-23	Identifying and using pipefitting tools	3	3
IPM-24	Identifying and using plumbing tools	3	3
IPM-25	Identifying and using electrical tools	3	3
IPM-26	Identifying and using cement, plaster and glazing tools	3	3
IPM-27	Identifying and using woodworking tools	3	3
IPM-28	Identifying and using sheet metal tools	3	3
IPM-29	Identifying and using metalworking tools	3	3
IPM-30	Identifying and using hoisting and pulling tools	3	3
	Total Quarter I Class and Lab Hours	110	126

Related Instructional Hours 76

Total Quarter I Instructional Hours 312

Quarter II

Task	Title	Class Hours	Lab Hours
IPM-31	Identifying plant safety procedures	2	0
IPM-32	Observing safety precautions for tools and equipment	2	0
IPM-33	Identifying machinery safeguards	2	0
IPM-34	Observing safety in handling materials	2	0
IPM-35	Identifying work area safety precautions	2	0
IPM-36	Identifying fire prevention procedures	2	0
IPM-37	Handling hazardous materials	2	0
IPM-38	Observing electrical safety precautions	2	0
IPM-39	Identifying personal protection gear	2	0
IPM-40	Identifying basic principles of lubrication	4	2
IPM-41	Identifying characteristics of lubricants	3	0
IPM-42	Identifying additives, lubricating action and bearing lubrication	4	2
IPM-43	Identifying oils and their applications	4	2
IPM-44	Identifying general purpose greases	4	2
IPM-45	Identifying special purpose greases	4	2
IPM-46	Identifying lubricating compounds	2	0
IPM-47	Identifying lubrication systems and methods	3	0
IPM-48	Identifying automatic lubrication methods	2	0
IPM-49	Identifying methods of lubricant storage and handling	4	2
IPM-50	Identifying common couplings	4	2
IPM-51	Identifying special couplings	3	0
IPM-52	Identifying clutches	4	2
IPM-53	Identifying V-belt drives	4	2
IPM-54	Identifying chain drives	4	2
IPM-55	Identifying speed reducers	4	2
IPM-56	Identifying gears	4	2
IPM-57	Identifying variable speed reducers	4	2
IPM-58	Identifying brakes and motors	13	10
IPM-59	Identifying principles of bearings and shafts	7	5
IPM-60	Identifying plain journal bearings	4	2
IPM-61	Identifying anti-friction bearings	4	2
IPM-62	Identifying ball and roller bearings	4	2
IPM-63	Identifying specialized bearings	4	2
IPM-64	Identifying bearing seals	4	2
IPM-65	Identifying methods of bearing lubrication	5	5
IPM-66	Maintaining bearings	10	14
IPM-67	Identifying pump application	2	0
IPM-68	Selecting a pump	2	0
IPM-69	Identifying centrifugal pumps	2	0
IPM-70	Identifying propeller and turbine pumps	2	0
IPM-71	Identifying rotary pumps	2	0
IPM-72	Identifying reciprocating pumps	2	0
IPM-73	Identifying metering pumps	2	0

Task	Title	Class Hours	Lab Hours
IPM-74	Identifying special purpose pumps	2	0
IPM-75	Installing packings and maintaining pump seals	3	2
IPM-76	Performing pump maintenance	0	3
IPM-77	Identifying piping systems and piping system maintenance	2	0
IPM-78	Maintaining metal pipe	0	2
IPM-79	Maintaining non-metallic piping	0	2
IPM-80	Maintaining tubing	0	2
IPM-81	Maintaining hoses	0	2
IPM-82	Maintaining fittings	0	2
IPM-83	Maintaining common valves	0	2
IPM-84	Identifying specialized valves	1	0
IPM-85	Maintaining strainers, filters and traps	2	3
IPM-86	Maintaining pipeline by monitoring accessories	2	2
IPM-87	Identifying principles of hydraulics	4	1
IPM-88	Identifying hydraulic fluids	4	1
IPM-89	Identifying strainers and filters in hydraulic systems	4	1
IPM-90	Identifying reservoirs and accumulators in a hydraulic system	4	1
IPM-91	Identifying hydraulic pumps on a system	4	1
IPM-92	Identifying piping, tubing and fittings	4	1
IPM-93	Identifying directional control valves	4	1
IPM-94	Identifying pressure control valves	2	1
IPM-95	Identifying cylinders in a hydraulic system	4	1
IPM-96	Identifying hydraulic motors	4	3
	Total Quarter II Class and Lab Hours	204	104

Related Instructional Hours 4
Total Quarter II Instructional Hours 312

Quarter III

Task	Title	Class Hours	Lab Hours
IPM-97	Troubleshooting hydraulic systems using schematics	4	6
IPM-98	Reading hydraulic schematic diagrams	4	6
IPM-99	Installing hydraulic components	4	6
IPM-100	Installing pipes and tubes	4	4
IPM-101	Selecting hydraulic fluids	4	2
IPM-102	Planning system maintenance	3	2
IPM-103	Troubleshooting hydraulic systems (diagnostic techniques)	4	6
IPM-104	Troubleshooting valves	2	3
IPM-105	Troubleshooting cylinders	4	6
IPM-106	Troubleshoot pumps and motors	2	8
IPM-107	Identifying pneumatic principles	4	1
IPM-108	Identifying reciprocating compressors	4	1
IPM-109	Identifying rotary compressors	4	1
IPM-110	Identifying primary air treatment in pneumatic systems	4	1
IPM-111	Identifying secondary air treatment methods	4	1
IPM-112	Identifying piping, hoses and fittings used in pneumatic systems	5	5
IPM-113	Identifying control valves	4	1
IPM-114	Identifying pressure relief valves	4	1
IPM-115	Identifying cylinders	2	1
IPM-116	Identifying motors	2	2
IPM-117	Identifying components of pneumatic systems	4	1
IPM-118	Reading pneumatic schematic diagrams	4	1
IPM-119	Installing system components	4	1
IPM-120	Identifying procedures for pneumatic system maintenance	5	5
IPM-121	Determining system failures	5	5
IPM-122	Troubleshooting air compressors	4	6
IPM-123	Troubleshooting control valves	4	6
IPM-124	Troubleshooting cylinders	2	3
IPM-125	Troubleshooting air motors	4	6
IPM-126	Troubleshooting pneumatic and hydraulic systems	2	4
	Total Quarter III Class and Lab Hours	110	102
	Related Instructional Hours	100	
	Total Quarter III Instructional Hours	312	

Quarter IV

Task	Title	Class Hours	Lab Hours
	DUTY II: ELECTRICAL MAINTENANCE		
EL-01	Identifying basic electrical theory	60	0
EL-02	Determining transformer polarity	10	5
EL-03	Connecting to and operating dual voltage single phase transformers	10	5
EL-04	Connecting single phase transformers in series	10	5
EL-05	Connecting single phase transformers in parallel	10	5
EL-06	Determining the KVA rating of single phase transformers	5	5
EL-07	Determining the KVA rating of three phase transformers	5	5
EL-08	Hooking up and operating a one phase auto transformer	5	5
EL-09	Hooking up a one phase buck booster transformer	5	5
EL-10	Hooking up a three phase transformer	5	5
EL-11	Hooking up a three phase auto transformer	5	5
EL-12	Hooking up a three phase transformer bank connected Wye/Wye	10	5
EL-13	Hooking up a three phase transformer bank connected Delta/Delta	10	5
EL-14	Hooking up a three phase bank of transformers open Delta	10	5
EL-15	Hooking up a three phase transformer bank connected Wye/Delta	10	5
EL-16	Hooking up a three phase transformer bank connected Delta/Wye	10	5
EL-17	Hooking up a three phase transformer bank; reversed voltage	10	5
EL-18	Hooking up transformers for special applications	10	5
	Total Quarter IV Class and Lab Hours	200	85

Related Instructional Hours 27
Total Quarter IV Instructional Hours 312

Quarter V

Task	Title	Class Hours	Lab Hours
EL-19	Calculating service load for a small commercial building	10	5
EL-20	Locating service entrance equipment and writing specifications	5	5
EL-21	Selecting a service entrance conductor	5	2
EL-22	Calculating service conduits	5	5
EL-23	Installing service conduits	5	10
EL-24	Installing service entrance conductors	5	10
EL-25	Selecting and installing meters	5	5
EL-26	Selecting and installing panels	5	5
EL-27	Calculating and installing motor branch circuits	5	5
EL-28	Installing and operating subfeeders and panels	5	5
EL-29	Grouping outlets onto branch circuits	5	5
EL-30	Installing specific purpose outlets	5	5
EL-31	Calculating branch circuit conductors and overcurrent protection	5	5
EL-32	Installing branch circuits and controls for lighting	5	5
EL-33	Selecting conduit	5	5
EL-34	Installing conduit under a concrete slab	5	5
EL-35	Installing outlet, junction and conduitlets	5	5
EL-36	Installing branch circuits and controls for air conditioning and heating	5	5
EL-37	Selecting and installing branch circuits for three phase water heaters	5	5
EL-38	Planning and performing site work for a small industrial facility	5	5
EL-39	Making calculations for electric motors, welders and heaters	5	5
EL-40	Calculating the 120 and 277 volt lighting load	5	5
EL-41	Calculating and selecting receptacles for 120/208 volt loads	5	5
EL-42	Calculating size for and selecting and installing Bass-Duct	5	5
EL-43	Selecting and installing a three phase, four wire 480v panel	5	5
EL-44	Selecting the correct transformer bank	4	2
EL-45	Selecting and installing a 480v/280-120 three phase four wire service	5	5
EL-46	Installing metering equipment	5	5
	Total Quarter V Class and Lab Hours	144	144

Related Instructional Hours 24
Total Quarter V Instructional Hours 312

Quarter IV

Task	Title	Class Hours	Lab Hours
EL-47	Selecting and installing panels and selecting distribution equipment	5	5
EL-48	Selecting and installing a 277v flourescent light	3	5
EL-49	Determining sizes and types of feeders and overcurrent protection devices	5	5
EL-50	Installing a branch circuit for welders	4	6
EL-51	Operating a split phase motor	4	4
EL-52	Operating a capacitor start motor	4	4
EL-53	Operating a universal motor	4	4
EL-54	Operating a three phase induction motor	4	4
EL-55	Operating a three phase synchronous motor	5	5
EL-56	Operating a three phase, one winding, two speed motor	4	4
EL-57	Operating a three phase, two winding, two speed motor	4	4
EL-58	Operating single and three phase alternators	4	4
EL-59	Operating an induction regulator	5	2
EL-60	Operating a rotary frequency changer	4	4
EL-61	Operating a synchronous rotary converter	4	4
EL-62	Operating a rotary converter	4	4
EL-63	Operating DC motors	4	4
EL-64	Operating and checking load characteristics of DC generators	5	5
EL-65	Correcting power factors	5	5
EL-66	Hooking up and operating gear motors	5	5
EL-67	Selecting correct machine drive	5	5
EL-68	Installing ventilator fans	5	5
EL-69	Identifying motor leads	4	4
EL-70	Identifying hazardous wiring locations	4	2
EL-71	Operating a power actuated tool	4	4
	Total Quarter VI Class and Lab Hours	108	107

Related Instructional Hours 97

Total Quarter VI Instructional Hours 312

Quarter VII

Task	Title	Class Hours	Lab Hours
MS-01	Laying out metal surfaces	2	2
MS-02	Identifying jig buttons	1	1
MS-03	Using the sine bar	2	2
MS-04	Using the bevel protractor	2	1
MS-05	Using steel rules	2	2
MS-06	Using the micrometer	2	4
MS-07	Reading a vernier scale	2	2
MS-08	Using dial indicators, center testers and speed indicators	2	4
MS-09	Using precision gage blocks, tapered ring, plug and snap gages	2	4
MS-10	Identifying and using hand hacksaws	2	1
MS-11	Using abrasives and lapping compounds	2	2
MS-12	Identifying and using files	2	1
MS-13	Scraping flat and curved bearing surfaces	2	1
MS-14	Using hammers and screwdrivers for hand bench use	2	1
MS-15	Identifying and using wrenches	2	1
MS-16	Using bench vises and clamps	2	1
MS-17	Identifying and using chipping tools	2	1
MS-18	Using hand taps, dies and hand reamers	2	4
MS-19	Identifying power tool safety practices	2	0
MS-20	Assembling and pitting	2	4
MS-21	Identifying fasteners	2	2
MS-22	Using thread, center, fillet and radius gages	2	4
MS-23	Identifying lubricants and greases	2	2
MS-24	Performing machine maintenance	2	4
MS-25	Identifying bench work safety	2	0
MS-26	Identifying parts and functions of the drilling machine	2	2
MS-27	Identifying safety practices and precautions when using the drilling machine	2	2
MS-28	Identifying work-holding devices and set ups	2	2
MS-29	Identifying and using drill bit holding devices	2	2
MS-30	Identifying drill bits	2	1
MS-31	Identifying cutting feeds and speeds	2	2
MS-32	Identifying principles of straight drilling	2	2
MS-33	Identifying and using coolants and cutting compounds	2	2
MS-34	Grinding and care of drills	2	2
MS-35	Identifying and using twist drill gages	2	2
MS-36	Identifying and using drill grinding machines	2	2
MS-37	Identifying machine reamers	2	1
MS-38	Machine reaming	2	2

Task	Title	Class Hours	Lab Hours
MS-39	Identifying principles of boring and counterboring	2	1
MS-40	Spot facing	2	2
MS-41	Counter sinking, center drilling and tapping	2	4
MS-42	Identifying lathe safety	2	0
MS-43	Identifying lathes	2	0
MS-44	Identifying work-holding devices	2	1
MS-45	Identifying cutting tools	2	1
MS-46	Identifying measuring tools	2	1
MS-47	Identifying lathe attachments	2	2
MS-48	Calculating cutting feeds and speeds on the lathe	2	2
MS-49	Determining RPM	2	2
MS-50	Centering stock	2	2
MS-51	Identifying principles of facing	2	1
MS-52	Identifying principles of straight turning and turning to shoulders	2	2
MS-53	Identifying checks	2	2
MS-54	Form turning	5	10
MS-55	Identifying faceplate work	2	2
MS-56	Using draw-in collets	5	5
MS-57	Identifying principles of drilling	2	2
MS-58	Identifying machine reamers	2	2
MS-59	Reaming on the engine lathe	2	5
MS-60	Boring on the engine lathe	2	5
MS-61	Identifying and using mandrels	2	5
MS-62	Knurling on the engine lathe	2	5
MS-63	Cutting off on the engine lathe	2	5
MS-64	Identifying thread cutting devices	2	2
MS-65	Identifying the parts of a thread	2	5

Total Quarter VII Class and Lab Hours 135 151
Related Instructional Hours 286
Total Quarter VII Instructional Hours 312

Quarter VIII

Task	Title	Class Hours	Lab Hours
MS-66	Identifying American National Thread standards	2	5
MS-67	Computing American National Thread form	2	5
MS-68	Computing sharp V-thread formulas	2	5
MS-69	Identifying acme threads	2	2
MS-70	Using the acme tap	2	5
MS-71	Identifying square threads	2	2
MS-72	Identifying classes of fits of screw threads	2	2
MS-73	Using threads gages	2	2
MS-74	Using a thread micrometer	2	5
MS-75	Measuring threads with the three-wire method	2	2
MS-76	Cutting threads with an even geared lathe	5	10
MS-77	Cutting threads on a lathe which is not even geared	5	10
MS-78	Cutting threads on a quick-change gear lathe	5	10
MS-79	Identifying multiple lead screw threads	2	2
MS-80	Cutting left hand threads	2	5
MS-81	Determining a tap drill size	2	2
MS-82	Cutting interval threads and tapping	2	5
MS-83	Identifying principles of taper turning	2	2
MS-84	Computing tapers	2	2
MS-85	Measuring short tapers	2	2
MS-86	Gaging inside and outside tapers	2	2
MS-87	Tapering by the offset tail stock methods	2	5
MS-88	Cutting a taper with the compound rest	2	5
MS-89	Cutting a taper with the taper attachment	2	5
MS-90	Boring or turning interval tapers	2	5
MS-91	Identifying coolants and cutting compounds	2	2
MS-92	Identifying lubricants	2	2
	Total Quarter VIII Class and Lab Hours	63	111

Related Instructional Hours 138

Total Quarter VIII Instructional Hours 312

Quarter I

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY I: WELDING		
WLD-01	Identifying and using welding symbols	10	4
WLD-02	Using welding related shop tools and equipment	10	25
WLD-03	Identifying and preparing metals for welding	10	25
WLD-04	Measuring welding materials	4	3
WLD-05	Using clamps and jigs	4	3
WLD-06	Reading blueprints	15	25
		53	85
	DUTY II: OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING		
OXA-01	Following safety procedures and regulations for oxyacetylene welding	3	1
OXA-02	Using oxyacetylene cylinders and gases	3	4
OXA-03	Inspecting oxygen and acetylene regulators	3	4
OXA-04	Selecting and maintaining oxyacetylene torches and tips	2	2
OXA-05	Setting up and lighting the oxyacetylene torch	2	2
OXA-06	Carrying a puddle without a filler rod	4	8
OXA-07	Welding an outside corner joint without a filler rod using oxyacetylene equipment	10	6
OXA-08	Making beads with filler rods using oxyacetylene equipment	10	6
OXA-09	Welding butt joints using oxyacetylene equipment	10	20
OXA-10	Welding lap joints using oxyacetylene equipment	10	20
OXA-11	Welding T-joints using oxyacetylene equipment	10	25
		67	98
	Total Quarter I Class and Lab Hours	120	183

Related Instructional Hours 9

Total Quarter I Instructional Hours 312

Quarter II

(Optional)

Task	Title	Class Hours	Lab Hours
OXA-12	Setting up the oxyacetylene apparatus for flame cutting	3	2
OXA-13	Cutting with an oxyacetylene cutting torch	5	15
OXA-14	Piercing and cutting holes using the oxyacetylene cutting torch	12	9
OXA-15	Cutting with an automatic oxyacetylene cutting machine	5	10
OXA-16	Welding beads with brass rods using oxyacetylene welding equipment	8	8
OXA-17	Brazing lap joint using oxyacetylene apparatus	5	15
OXA-18	Brazing with silver using oxyacetylene equipment	5	15
OXA-19	Soldering	5	15
OXA-20	Welding cast iron using oxyacetylene apparatus	4	6
OXA-21	Cutting and welding pipe using oxyacetylene apparatus	5	15
		57	110
	DUTY III: **SHIELDED ARC WELDING**		
ARC-01	Selecting and setting up shielded arc welding apparatus	5	10
ARC-02	Welding string and weave beads using shielded arc welding apparatus	5	15
ARC-03	Arc welding string beads and padding a plate	5	10
ARC-04	Arc welding lap joints	5	10
ARC-05	Arc welding butt joints	5	15
ARC-06	Shielded arc welding T-fillet joints	5	15
ARC-07	Testing arc welded joints	4	6
		34	81
	Total Quarter II Class and Lab Hours	91	191
	Related Instructional Hours	30	
	Total Quarter II Instructional Hours	312	

Quarter III

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY IV: AIR CONDITIONING AND HEATING MAINTENANCE		
AC-01	Identifying major components and functions of air conditioning systems	6	4
AC-02	Applying basic air principles	6	4
AC-03	Calculating heat loads	5	5
AC-04	Applying principles of air movement	5	10
AC-05	Servicing air filtering systems	5	10
AC-06	Installing condensate drains	6	4
AC-07	Installing residential and mobile home package air conditioning units	6	4
AC-08	Installing split system air conditioning units	6	4
AC-09	Installing add-on split air conditioning systems	6	4
AC-10	Troubleshooting compressor burnout	6	4
AC-11	Troubleshooting fans and fan motors	6	4
AC-12	Performing pre-season start-up air conditioning service	6	4
AC-13	Troubleshooting air conditioner refrigeration cycle	6	4
AC-14	Troubleshooting air conditioner electrical cycle	6	4
AC-15	Troubleshooting air conditioner air movement	6	4
		87	73
	DUTY V: HEAT PUMPS		
AC-16	Applying principles of the heat pump	6	4
AC-17	Evacuating and charging the heat pump	6	4
AC-18	Installing a reversing valve	6	4
AC-19	Tracing the heat pump refrigeration cycle	6	4
AC-20	Installing electrical circuits	6	4
AC-21	Adjusting and repairing defrost controls	4	2
AC-22	Installing package heat pumps	3	9
AC-23	Installing split-system heat pumps	3	9
		40	40
	Total Quarter III Class and Lab Hours	127	113

Total Instructional Hours 72

Total Quarter III Instructional Hours 312

Quarter IV

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY VI: **HEATING**		
HE-01	Applying principles of electric furnaces and controls	6	4
HE-02	Installing electric furnaces	6	6
HE-03	Troubleshooting electric furnaces	4	6
HE-04	Applying gas fuel combustion and safety principles	6	2
HE-05	Identifying major components and functions of gas heating systems	6	4
HE-06	Checking gas sources	6	4
HE-07	Applying gas piping principles	6	4
HE-08	Installing and adjusting gas regulators	6	4
HE-09	Installing and servicing gas valves	6	4
HE-10	Installing and servicing pilot ignition devices	6	4
HE-11	Installing and servicing combination gas valves	6	4
HE-12	Servicing gas burners	6	4
HE-13	Inspecting and adjusting temperature rise of heat exchangers	6	4
HE-14	Venting gas heating systems	6	4
HE-15	Servicing gas furnace electrical controls	6	4
HE-16	Determining combustion efficiency	6	2
HE-17	Performing a pre-season check-up and start-up on a gas furnace	6	2
HE-18	Troubleshooting the gas heating system	6	4
HE-19	Identifying types of fuel oil and principles of combustion	6	4
HE-20	Designing and installing oil piping	6	6
HE-21	Installing oil burners	6	4
HE-22	Installing and servicing transformers and electrodes	6	4
HE-23	Installing oil pumps	6	4
HE-24	Servicing blower, nozzle, motor and coupling	6	4
HE-25	Performing the combustion efficiency test	6	2
HE-26	Installing controls	6	4
HE-27	Performing pre-season start-up and check-up on an oil burning heating system	6	4
HE-28	Troubleshooting the oil burning heating system	6	4
	Total Quarter IV Class and Lab Hours	166	110
	Related Instructional Hours	36	
	Total Quarter IV Instructional Hours	312	

Quarter V

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY VII: SHEET METAL		
SM-01	Identifying materials used in sheet metalwork	4	2
SM-02	Developing sheet metal patterns (stretchouts)	6	4
SM-03	Cutting sheet metal	6	4
SM-04	Bending sheet metal by hand	6	4
SM-05	Bending metal on a bar folder or brake	6	4
SM-06	Roll-forming sheet metal	6	4
SM-07	Making seams	6	4
SM-08	Using the rotary machine	6	4
SM-09	Fastening sheet metal	6	4
	Total Quarter V Class and Lab Hours	52	34
	Related Instructional Hours	226	
	Total Quarter V Instructional Hours	312	

Quarter VI

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY VIII: VEHICLE MAINTENANCE		
VM-01	Reading and interpreting the shop service manuals	4	0
VM-02	Identifying and maintaining shop tools and equipment	6	4
VM-03	Using precision measurement tools and equipment	4	2
VM-04	Demonstrating engine theories of operation	4	2
VM-05	Demonstrating a knowledge of electricity fundamentals	4	2
VM-06	Demonstrating a knowledge of fuels	1	1
VM-07	Demonstrating a knowledge of lubricants	1	1
VM-08	Demonstrating a knowledge of hardware and fasteners	1	1
VM-09	Demonstrating basic metal operations	4	2
VM-10	Demonstrating welding and soldering techniques	4	2
		33	17
	DUTY IX: SYSTEMS REPAIR		
VM-11	Checking and changing engine oil and oil filter	1	1
VM-12	Checking fluid level and refilling transmission and rear end	2	2
VM-13	Lubricating chassis and components	1	1
VM-14	Checking and replacing windshield wiper blades	1	1
VM-15	Repairing tires and tubes	1	1
VM-16	Replacing light bulbs and fuses	1	2
VM-17	Washing and waxing vehicle	4	2
VM-18	Adjusting fuel/air mixtures and mechanical linkage	1	2
VM-19	Cleaning or replacing fuel and air filters	1	2
VM-20	Removing carburetor from engine	4	2
VM-21	Disassembling, cleaning and inspecting carburetor	6	4
VM-22	Reassembling and testing carburetor	6	4
VM-23	Testing and replacing fuel pump	4	2
VM-24	Servicing fuel tank, lines, hoses and fuel level monitoring devices	6	2
VM-25	Diagnosing fuel system problems	4	2
VM-26	Inspecting, selecting and installing spark plugs	4	2
VM-27	Timing the ignition	2	0
VM-28	Inspecting and replacing circuit wiring, distributor cap and rotor	4	2

Task	Title	Class Hours	Lab Hours
VM-29	Testing, removing and replacing battery ignition components	6	2
VM-30	Testing, removing and replacing electronic ignition components	6	4
VM-31	Using and interpreting the ignition analyzer	6	4
VM-32	Diagnosing ignition system problems	4	4
VM-33	Servicing battery and cables	2	2
		77	50

Total Quarter VI Class and Lab Hours 110 67
Related Instructional Hours 135
Total Quarter VI Instructional Hours 312

Quarter VII

(Optional)

Task	Title	Class Hours	Lab Hours
	DUTY X: CARPENTRY		
C-01	Reading a rule	5	5
C-02	Reading a scale	2	2
C-03	Reading orthographic drawings	1	1
C-04	Identifying elevations	1	1
C-05	Identifying symbols	1	1
C-06	Using hand tools (tooth cutting tools, edge cutting tools, boring tools, assembly tools, smoothing tools)	6	4
C-07	Using measuring tools	1	1
C-08	Using fasteners (nails and brads, screws and glue)	4	2
C-09	Using portable power tools (circular saw, saber saw, electric drill, electric router, belt sander and finishing sander)	10	10
C-10	Surfacing stock, joining edges and dressing to thickness (joiner and planer)	6	6
C-11	Ripping stock - lumber or plywood (table saw)	2	6
C-12	Cutting stock to length (radial arm saw)	1	3
C-13	Material (band saw and scroll saw)	3	3
C-14	Shaping to pattern (shaper)	8	4
C-15	Making wood joints	5	15
C-16	Turning stock - cylindrical and faceplate (wood lathe)	3	5
C-17	Boring holes and cutting plugs (drill press)	2	3
C-18	Sanding flat surfaces (belt and disk sanding machines)	4	2
	Total Quarter VII Class and Lab Hours	65	74
	Related Instructional Hours	173	
	Total Quarter VII Instructional Hours	312	

SECTION V

RECORDS

Section V Content List

Individualized Competency Record
Group Progress Chart

Section V presents suggested ways of recording and documenting the progress of students through the curriculum. The recommended procedures include options for both individual and group records. The very important function of communicating the student's qualifications to potential employers is handled clearly and efficiently by the use of the Certificate of Competency, which is also described in this section.

RECORDS MANAGEMENT

This guide provides a series of easy to use documents that will aid the instructor in recordkeeping and that will be beneficial to the student in entering the work force.

In addition to providing the instructor with an "at a glance" assessment of individual and/or group progress, a Certificate of Competency, which can be used by students seeking employment, is included.

The group progress chart reflects individual task completion of all students. Due to confidentiality of records, grades must not be recorded on the chart. A notation indicating task completion (i.e., x or check) should be used.

INSTRUCTIONS

Instructions

Competency Checklist

1) Enter the student's name.
2) Enter the date and instructor's initials as each unit of instruction is completed.

The Competency Checklist automatically indicates when all the requirements for each DOT exit point or job title have been completed by the student. At each point on the certificate where an asterisk appears, the student is eligible to receive a Certificate of Competency.

Certificate of Competency

A Certificate of Competency is to be issued for each job title for which a student is qualified.

1) Enter the student's name.
2) Enter the school's name
3) Sign and date the form.

A Certificate of Competency may be issued at the time a student qualifies for it, or all certificates for which a student qualifies may be issued to the student when he/she completes or leaves the program.

Group Progress Chart

1) Enter all program tasks across top of matrix.
2) Enter the students' names down the left hand side of matrix.
3) As each student completes a task, a notation should be made in the square which corresponds with the task and the student's name.

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:_________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS					
				DOT NO. JOB TITLE					
				638.281-014 Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
	INDUSTRIAL PROCESS AND MAINTENANCE								
IPM-01	Identifying basic principles of blueprint reading			X	X		X	X	X
IPM-02	Identifying elements of machine drawings			X	X		X	X	X
IPM-03	Identifying hydraulic and pneumatic drawings			X			X	X	X
IPM-04	Using machine drawings in the maintenance of machinery and equipment			X	X				
IPM-05	Reading building drawings			X					
IPM-06	Reading electrical drawings			X		X			
IPM-07	Reading pipe system drawings			X					
IPM-08	Reading sheet metal drawings			X	X				
IPM-09	Using shop math to interpret blueprints			X	X				
IPM-10	Sketching schematic diagrams			X	X	X			
IPM-11	Identifying types of schematics used in plant engineering			X		X			
IPM-12	Identifying the symbols on electrical piping and fluid power diagrams			X					
IPM-13	Identifying guidelines for reading schematics			X		X			
IPM-14	Identifying electrical symbols			X		X			
IPM-15	Reading electrical diagrams			X		X			
IPM-16	Identifying piping symbols			X					
IPM-17	Reading piping schematics			X					
IPM-18	Identifying fluid power symbols			X					
IPM-19	Reading fluid power schematics			X					
IPM-20	Identifying welding symbols			X	X				
IPM-21	Identifying and using basic measuring tools			X	X				
IPM-22	Identifying and using wrenches and screwdrivers			X	X	X	X	X	X
IPM-23	Identifying and using pipefitting tools			X			X	X	X
IPM-24	Identifying and using plumbing tools			X		X	X	X	X
IPM-25	Identifying and using electrical tools			X		X	X	X	X
IPM-26	Identifying and using cement, plaster and glazing tools			X			X	X	X
IPM-27	Identifying and using woodworking tools			X			X	X	X
IPM-28	Identifying and using sheet metal tools			X	X		X	X	X
IPM-29	Identifying and using metalworking tools			X	X		X	X	X
IPM-30	Identifying and using hoisting and pulling tools			X	X		X	X	X
IPM-31	Identifying plant safety procedures			X	X	X	X	X	X
IPM-32	Observing safety precautions for tools and equipment			X	X	X	X	X	X
IPM-33	Identifying machinery safeguards			X	X	X	X	X	X
IPM-34	Observing safety in handling materials			X	X	X	X	X	X
IPM-35	Identifying work area safety precautions			X	X	X	X	X	X
IPM-36	Identifying fire prevention procedures			X	X	X	X	X	X
IPM-37	Handling hazardous materials			X	X	X	X	X	X
IPM-38	Observing electrical safety precautions			X	X	X	X	X	X
IPM-39	Identifying personal protection gear			X	X	X	X	X	X
IPM-40	Identifying basic principles of lubrication			X	X		X	X	X
IPM-41	Identifying characteristics of lubricants			X	X		X	X	X
IPM-42	Identifying additives, lubricating action and bearing lubrication			X	X		X	X	X
IPM-43	Identifying oils and their applications			X	X		X	X	X
IPM-44	Identifying general purpose greases			X	X		X	X	X
IPM-45	Identifying special purpose greases			X	X		X	X	X
IPM-46	Identifying lubricating compounds			X	X		X	X	X

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:__________________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 633.281-014 JOB TITLE Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
IPM-47	Identifying lubrication systems and methods			X	X				
IPM-48	Identifying automatic lubrication methods			X	X		X	X	X
IPM-49	Identifying methods of lubricant storage and handling			X	X		X	X	X
IPM-50	Identifying common couplings			X	X		X		
IPM-51	Identifying special couplings			X	X		X		
IPM-52	Identifying clutches			X	X		X		
IPM-53	Identifying V-belt drives			X	X		X	X	X
IPM-54	Identifying chain drives			X	X		X	X	X
IPM-55	Identifying speed reducers			X	X		X		
IPM-56	Identifying gears			X	X		X		
IPM-57	Identifying variable speed reducers			X					
IPM-58	Identifying brakes and motors			X	X		X		
IPM-59	Identifying principles of bearings and shafts			X	X		X		
IPM-60	Identifying plain journal bearings			X	X		X		
IPM-61	Identifying anti-friction bearings			X	X		X		
IPM-62	Identifying ball and roller bearings			X	X		X		
IPM-63	Identifying specialized bearings			X	X		X		
IPM-64	Identifying bearing seals			X	X		X	X	X
IPM-65	Identifying methods of bearing lubrication			X	X		X	X	X
IPM-66	Maintaining bearings			X			X		
IPM-67	Identifying pump application			X			X		
IPM-68	Selecting a pump			X			X		
IPM-69	Identifying centrifugal pumps			X			X		
IPM-70	Identifying propeller and turbine pumps			X			X		
IPM-71	Identifying rotary pumps			X			X		
IPM-72	Identifying reciprocating pumps			X			X		
IPM-73	Identifying metering pumps			X			X		
IPM-74	Identifying special purpose pumps			X			X		
IPM-75	Installing packings and maintaining pump seals			X			X	X	X
IPM-76	Performing pump maintenance			X			X		
IPM-77	Identifying piping systems and piping system maintenance			X			X	X	X
IPM-78	Maintaining metal pipe			X			X		
IPM-79	Maintaining non-metallic piping			X		X			
IPM-80	Maintaining tubing			X		X			
IPM-81	Maintaining hoses			X		X			
IPM-82	Maintaining fittings			X		X			
IPM-83	Maintaining common valves			X		X			
IPM-84	Identifying specialized valves			X		X			
IPM-85	Maintaining strainers, filters and traps			X		X			
IPM-86	Maintaining pipeline by monitoring accessories			X		X			
IPM-87	Identifying principles of hydraulics			X		X			
IPM-88	Identifying hydraulic fluids			X		X			
IPM-89	Identifying strainers and filters in hydraulic systems			X		X			
IPM-90	Identifying reservoirs and accumulators in a hydraulic system			X		X			
IPM-91	Identifying hydraulic pumps on a system			X		X			
IPM-92	Identifying piping, tubing and fittings			X		X			
IPM-93	Identifying directional control valves			X		X			
IPM-94	Identifying pressure control valves			X		X			
IPM-95	Identifying cylinders in a hydraulic system			X		X			

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:____________________________

				EXIT POINTS					
TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 638.281-014 JOB TITLE Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
IPM-96	Identifying hydraulic motors			X		X			
IPM-97	Troubleshooting hydraulic systems using schematics			X		X			
IPM-98	Reading hydraulic schematic diagrams			X		X			
IPM-99	Installing hydraulic components			X		X			
IPM-100	Installing pipes and tubes			X		X			
IPM-101	Selecting hydraulic fluids			X		X			
IPM-102	Planning system maintenance			X		X			
IPM-103	Troubleshooting hydraulic systems (diagnostic techniques)			X		X			
IPM-104	Troubleshooting valves			X		X			
IPM-105	Troubleshooting cylinders			X		X			
IPM-106	Troubleshooting pumps and motors			X		X			
IPM-107	Identifying pneumatic principles			X		X			
IPM-108	Identifying reciprocating compressors			X		X			
IPM-109	Identifying rotary compressors			X		X			
IPM-110	Identifying primary air treatment in pneumatic systems			X		X			
IPM-111	Identifying secondary air treatment methods			X		X			
IPM-112	Identifying piping, hoses and fittings used in pneumatic systems			X		X			
IPM-113	Identifying control valves			X		X			
IPM-114	Identifying pressure relief valves			X		X			
IPM-115	Identifying cylinders			X		X			
IPM-116	Identifying motors			X		X			
IPM-117	Identifying components of pneumatic systems			X		X			
IPM-118	Reading pneumatic schematic diagrams			X		X			
IPM-119	Installing system components			X		X			
IPM-120	Identifying procedures for pneumatic system maintenance			X		X			
IPM-121	Determining system failures			X		X			
IPM-122	Troubleshooting air compressors			X		X			
IPM-123	Troubleshooting control valves			X		X			
IPM-124	Troubleshooting cylinders			X		X			
IPM-125	Troubleshooting air motors			X		X			
IPM-126	Troubleshooting pneumatic and hydraulic systems			X		X			
	ELECTRICAL MAINTENANCE								
EL-01	Identifying basic electrical theory			X		X	X	X*	X*
EL-02	Determining transformer polarity			X		X	X		
EL-03	Connecting to and operating dual voltage single phase transformers			X		X			
EL-04	Connecting single phase transformers in series			X		X			
EL-05	Connecting single transformers in parallel			X		X			
EL-06	Determining the KVA rating of single phase transformers			X		X			
EL-07	Determining the KVA rating of three phase transformers			X		X			
EL-08	Hooking up and operating a one phase auto transformer			X		X			
EL-09	Hooking up a one phase booster			X		X			
EL-10	Hooking up a three phase transformer			X		X			
EL-11	Hooking up a three phase auto transformer			X		X			
EL-12	Hooking up a three phase transformer bank connected Wye/Wye			X		X			
EL-13	Hooking up a three phase transformer bank connected Delta/Delta			X		X			

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:______________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. JOB TITLE 633.281-014 Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
EL-14	Hooking up a three phase bank of transformers open Delta			X		X			
EL-15	Hooking up a three phase transformer bank connected Wye/Delta			X		X			
EL-16	Hooking up a three phase transformer bank connected Delta/Wye			X		X			
EL-17	Hooking up a three phase transformer bank; reversed voltage			X		X			
EL-18	Hooking up transformers for special applications			X		X			
EL-19	Calculating service load for a small commercial building			X		X			
EL-20	Locating service entrance equipment and wiring specifications			X		X			
EL-21	Selecting a service entrance conductor			X		X			
EL-22	Calculating service conduits			X		X			
EL-23	Installing service conduits			X		X			
EL-24	Installing service entrance conductors			X		X			
EL-25	Selecting and installing meters			X		X			
EL-26	Selecting and installing panels			X		X			
EL-27	Calculating and installing motor branch circuits			X		X			
EL-28	Installing and operating subfeeders and panels			X		X	X		
EL-29	Grouping outlets onto branch circuits			X		X			
EL-30	Installing specific purpose outlets			X		X	X		
EL-31	Calculating branch circuit conductors and overcurrent protection			X		X			
EL-32	Installing branch circuits and controls			X		X			
EL-33	Selecting conduit			X		X			
EL-34	Installing conduit under a concrete slab			X		X			
EL-35	Installing outlet, junction and conduitlets			X		X			
EL-36	Installing branch circuits and controls for air conditioning and heating			X		X			
EL-37	Selecting and installing branch circuits for three phase water heaters			X		X			
EL-38	Planning and performing site work for a small industrial facility			X		X			
EL-39	Making calculations for electric motors, welders and heaters			X		X			
EL-40	Calculating the 120 and 277 volt lighting load			X		X			
EL-41	Calculating and selecting receptacles for 120/208 volt loads			X		X			
EL-42	Calculating size for and selecting and installing a Bass-Duct			X		X			
EL-43	Selecting and installing a three phase, four wire 480v panel			X		X			
EL-44	Selecting the correct transformer bank			X		X			
EL-45	Selecting and installing a 480v/280-120 three phase four wire service			X		X			
EL-46	Installing metering equipment			X		X			
EL-47	Selecting and installing panels and selecting distribution equipment			X		X			
EL-48	Selecting and installing a 277v flourescent light			X		X			

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:_________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS DOT NO. 633.281-014 JOB TITLE Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
EL-49	Determining sizes and types of feeders and overcurrent protection devices			X		X			
EL-50	Installing a branch circuit for welders			X		X			
EL-51	Operating a split phase motor			X		X			
EL-52	Operating a capacitor start motor			X		X			
EL-53	Operating a universal motor			X		X			
EL-54	Operating a three phase induction motor			X		X			
EL-55	Operating a three phase synchronous motor			X		X			
EL-56	Operating a three phase, one winding, two speed motor			X		X			
EL-57	Operating a three phase, two winding, two speed motor			X		X			
EL-58	Operating single and three phase alternators			X		X			
EL-59	Operating an induction regulator			X		X			
EL-60	Operating a rotary frequency changer			X		X			
EL-61	Operating a synchronous rotary converter			X		X			
EL-62	Operating a rotary converter			X		X			
EL-63	Operating DC motors			X		X			
EL-64	Operating and checking load characteristics of DC generators			X		X			
EL-65	Correcting power factors			X		X			
EL-66	Hooking up and operating gear motors			X		X			
EL-67	Selecting correct machine drive			X		X			
EL-68	Installing ventilator fans			X		X			
EL-69	Identifying motor leads			X		X			
EL-70	Identifying hazardous wiring locations			X		X			
EL-71	Operating a power actuated tool			X		X*			
	MACHINE SHOP								
MS-01	Laying out metal surfaces			X	X				
MS-02	Identifying jig buttons			X	X				
MS-03	Using the sine bar			X	X				
MS-04	Using the bevel protractor			X	X				
MS-05	Using steel rules			X	X				
MS-06	Using the micrometer			X	X				
MS-07	Reading a vernier scale			X	X				
MS-08	Using dial indicators, center testers and speed indicators			X	X				
MS-09	Using precision gage blocks, tapered ring, plug and snap gages			X	X				
MS-10	Identifying and using hand hacksaws			X	X				
MS-11	Using abrasives and applying compounds			X	X				
MS-12	Identifying and using files			X	X				
MS-13	Scraping flat and curved bearing surfaces			X	X				
MS-14	Using hammers and screwdrivers for hand bench use			X	X				
MS-15	Identifying and using wrenches			X	X				
MS-16	Using bench vises and clamps			X	X				
MS-17	Identifying and using chipping tools			X	X				
MS-18	Using hand taps, dies and hand reamers			X	X				
MS-19	Identifying power tool safety practices			X	X				
MS-20	Assembling and fitting			X	X				
MS-21	Identifying fasteners			X	X				
MS-22	Using thread, center, fillet and radius gages			X	X				

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:_________________________

				EXIT POINTS					
TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 633.281-014 JOB TITLE Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
MS-23	Identifying lubricants and greases			X	X				
MS-24	Performing machine maintenance			X	X				
MS-25	Identifying bench work safety			X	X				
MS-26	Identifying parts and functions of the drilling machine			X	X				
MS-27	Identifying safety practices and precautions when using the drilling machine			X	X				
MS-28	Identifying work-holding devices and set ups			X	X				
MS-29	Identifying and using the drill bit holding devices			X	X				
MS-30	Identifying drill bit			X	X				
MS-31	Identifying cutting feeds and speeds			X	X				
MS-32	Identifying principles of straight drilling			X	X				
MS-33	Identifying and using coolants and cutting compounds			X	X				
MS-34	Grinding and caring of drills			X	X				
MS-35	Identifying and using twist drill gages			X	X				
MS-36	Identifying and using drill grinding			X	X				
MS-37	Identifying machine reamers			X	X				
MS-38	Performing machine reaming with the drilling machine			X	X				
MS-39	Identifying principles of boring and counterboring			X	X				
MS-40	Using the drill press in spot facing operations			X	X				
MS-41	Performing counter sinking and center drilling operations			X	X				
MS-42	Identifying lathe safety			X	X				
MS-43	Identifying lathes			X	X				
MS-44	Identifying work-holding devices			X	X				
MS-45	Identifying cutting tools			X	X				
MS-46	Identifying measuring tools			X	X				
MS-47	Identifying lathe attachments			X	X				
MS-48	Calculating cutting feeds and speeds on the lathe			X	X				
MS-49	Determining RPM			X	X				
MS-50	Centering stock			X	X				
MS-51	Identifying principles of facing			X	X				
MS-52	Identifying principles of straight turning and turning to shoulders			X	X				
MS-53	Identifying chucks			X	X				
MS-54	Performing form turning operations			X	X				
MS-55	Identifying principles of faceplate work			X	X				
MS-56	Using draw-in collets			X	X				
MS-57	Identifying principles of drilling			X	X				
MS-58	Identifying machine reamers			X	X				
MS-59	Performing reaming operations on the engine lathe			X	X				
MS-60	Performing boring operations on the engine lathe			X	X				
MS-61	Identifying and using mandrels			X	X				
MS-62	Performing knurling operations on the engine lathe			X	X				
MS-63	Performing cutting off operations on the engine lathe			X	X				
MS-64	Identifying thread cutting devices			X	X				
MS-65	Identifying the parts of a thread			X	X				
MS-66	Identifying American National thread standards			X	X				
MS-67	Computing American National thread form			X	X				
MS-68	Computing sharp V-thread formulas			X	X				
MS-69	Identifying acme threads			X	X				
MS-70	Using the acme tap			X	X				

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:__________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS DOT NO. JOB TITLE 633.281-014 Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
MS-71	Identifying square threads			X	X				
MS-72	Identifying classes of fits of screw threads			X	X				
MS-73	Using thread gages			X	X				
MS-74	Using a thread micrometer			X	X				
MS-75	Measuring threads using the three-wire method			X	X				
MS-76	Cutting threads with an even geared lathe			X	X				
MS-77	Cutting threads on a lathe which is not even geared			X	X				
MS-78	Cutting threads on a quick-change gear lathe			X	X				
MS-79	Identifying multiple lead screw threads			X	X				
MS-80	Cutting left hand threads			X	X				
MS-81	Determining a tap drill size			X	X				
MS-82	Cutting internal threads and performing tapping operation			X	X				
MS-83	Identifying principles of taper turning			X	X				
MS-84	Computing tapers			X	X				
MS-85	Measuring short tapers			X	X				
MS-86	Gaging inside and outside tapers			X	X				
MS-87	Tapering using the offset tailstock method			X	X				
MS-88	Cutting a taper using the compound rest			X	X				
MS-89	Cutting a taper using the taper attachment			X	X				
MS-90	Boring or turning internal tapers			X	X				
MS-91	Identifying coolants and cutting compounds			X	X				
MS-92	Identifying lubricants			X	X*				
	WELDING								
WLD-01	Identifying and using welding symbols			X					
WLD-02	Using welding related shop tools			X					
WLD-03	Identifying and preparing metals for welding			X					
WLD-04	Measuring welding materials			X					
WLD-05	Using clamps and jigs			X					
WLD-06	Reading blueprints			X					
	OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING								
OXA-01	Following safety procedures and regulations for oxyacetylene welding			X					
OXA-02	Using oxyacetylene cylinders and gases			X					
OXA-03	Inspecting oxygen and acetylene regulators			X					
OXA-04	Selecting and maintaining oxyacetylene torches and tips			X					
OXA-05	Setting up and lighting the oxyacetylene torch			X					
OXA-06	Carrying a puddle without a filler rod			X					
OXA-07	Welding an outside corner joint without a filler rod			X					
OXA-08	Making beads with filler rods			X					
OXA-09	Welding butt joints			X					
OXA-10	Welding lap joints			X					
OXA-11	Welding T-joints			X					
OXA-12	Setting up the oxyacetylene apparatus for flame cutting			X					
OXA-13	Cutting with an oxyacetylene cutting torch			X					
OXA-14	Piercing and cutting holes			X					
OXA-15	Cutting with an automatic oxyacetylene cutting machine			X					
OXA-16	Welding beads with brass rods			X					
OXA-17	Brazing a lap joint using oxyacetylene apparatus			X					

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME: ________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS					
				DOT NO. JOB TITLE					
				638.281-014 Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
OXA-18	Brazing with silver			X					
OXA-19	Soldering copper, sheet metal and other metals			X					
OXA-20	Welding cast iron			X					
OXA-21	Cutting and welding pipe			X					
	SHIELDED ARC WELDING								
ARC-01	Selecting and setting up shielded arc welding apparatus			X					
ARC-02	Welding string and weave beads			X					
ARC-03	Arc welding string beads and padding a plate			X					
ARC-04	Arc welding lap joints			X					
ARC-05	Arc welding butt joints			X					
ARC-06	Shield arc welding T-fillet joints			X					
ARC-07	Testing arc welded joints			X					
	AIR CONDITIONING AND HEATING								
AC-01	Identifying major components and functions of air conditioning systems			X					
AC-02	Applying basic air principles			X					
AC-03	Calculating heat loads			X					
AC-04	Applying principles of air movement			X					
AC-05	Servicing air filtering systems			X					
AC-06	Installing condensate drains			X					
AC-07	Installing residential and mobile home package air conditioning units			X					
AC-08	Installing split system air conditioning units			X					
AC-09	Installing add-on split air conditioning systems			X					
AC-10	Troubleshooting compressor burnout			X					
AC-11	Troubleshooting fans and fan motors			X					
AC-12	Performing pre-season start-up and air conditioner service			X					
AC-13	Troubleshooting air conditioner refrigeration cycle			X					
AC-14	Troubleshooting air conditioner electrical cycle			X					
AC-15	Troubleshooting air conditioner air movement			X					
AC-16	Applying principles of the heat pump			X					
AC-17	Evacuating and charging a heat pump			X					
AC-18	Installing a reversing valve			X					
AC-19	Tracing the heat pump refrigeration cycle			X					
AC-20	Installing electrical circuits			X					
AC-21	Adjusting and repairing defrost controls			X					
AC-22	Installing package heat pumps			X					
AC-23	Installing split-system heat pumps			X					
	HEATING								
HE-01	Applying principles of electric furnaces and controls			X					
HE-02	Installing electric furnaces			X					
HE-03	Troubleshooting electric furnaces			X					
HE-04	Applying gas fuel combustion and safety principles			X					
HE-05	Identifying major components and functions of gas heating systems			X					
HE-06	Checking gas sources			X					
HE-07	Applying gas piping principles								

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:____________________________

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	EXIT POINTS					
DOT NO.				633.281-014	600.280-042	825.281-014	899.281-014	633.684-018	899.684-022
JOB TITLE				Maintenance Mechanic	Maintenance Machinist	Electrical Repairer	Maintenance Repairer	Maintenance Mechanic Helper	Maintenance Repairer Helper
HE-08	Installing and adjusting gas regulators			X					
HE-09	Installing and servicing gas valves			X					
HE-10	Installing and servicing pilot ignition devices			X					
HE-11	Installing and servicing combination gas valves			X					
HE-12	Servicing gas burners			X					
HE-13	Inspecting and adjusting temperature rise of heat exchangers			X					
HE-14	Venting gas heating systems			X					
HE-15	Servicing gas furnace electrical controls			X					
HE-16	Determining combustion efficiency			X					
HE-17	Performing a pre-season check-up and start-up on a gas furnace			X					
HE-18	Troubleshooting the gas heating system			X					
HE-19	Identifying types of fuel oil and their principles of combustion			X					
HE-20	Designing and installing oil piping			X					
HE-21	Installing oil burners			X					
HE-22	Installing and servicing transformers and electrodes			X					
HE-23	Installing oil pumps			X					
HE-24	Servicing blower, nozzle, motor and coupling			X					
HE-25	Performing the combustion efficiency test			X					
HE-26	Installing controls			X					
HE-27	Performing pre-season start-up and check-up on an oil burning heating system			X					
HE-28	Troubleshooting the oil burning heating system			X					
	SHEET METAL								
SM-01	Identifying materials used in sheet metalwork			X					
SM-02	Developing sheet metal patterns			X					
SM-03	Cutting sheet metal			X					
SM-04	Bending sheet metal by hand			X					
SM-05	Bending metal on a bar folder or brake			X					
SM-06	Roll-forming sheet metal			X					
SM-07	Making seams			X					
SM-08	Using the rotary machine			X					
SM-09	Fastening sheet metal			X					
	VEHICLE MAINTENANCE								
VM-01	Reading and interpreting the shop service manual			X					
VM-02	Identifying and maintaining shop tools and equipment			X					
VM-03	Using precision measurement tools and equipment			X					
VM-04	Demonstrating an understanding of engine theories of operation			X					
VM-05	Demonstrating a knowledge of electricity fundamentals			X					
VM-06	Demonstrating an understanding of fuels			X					
VM-07	Demonstrating an understanding of lubricants			X					
VM-08	Demonstrating an understanding of hardward and fasteners			X					
VM-09	Demonstrating basic metals operation			X					
VM-10	Demonstrating welding and soldering techniques			X					

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:____________________________

EXIT POINTS

TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. JOB TITLE 638.281-014 Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	638.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
	AUTOMOTIVE SYSTEMS REPAIR								
VH-11	Checking and changing engine oil and oil filter			X					
VH-12	Checking fluid level and refilling transmission and rear end			X					
VH-13	Lubricating chassis and components			X					
VH-14	Checking and replacing windshield wiper blades			X					
VH-15	Repairing tires and tubes			X					
VH-16	Replacing light bulbs and fuses			X					
VH-17	Washing and waxing vehicle			X					
VH-18	Adjusting fuel/air mixtures and mechanical linkage			X					
VH-19	Cleaning or replacing fuel air and air filters			X					
VH-20	Removing carburetor from engine			X					
VH-21	Disassembling, cleaning and inspecting carburetor			X					
VH-22	Reassembling and testing carburetor			X					
VH-23	Testing and replacing fuel pumps			X					
VH-24	Servicing fuel tank, lines, hoses and fuel level monitoring devices			X					
VH-25	Diagnosing fuel system problems			X					
VH-26	Inspecting, selecting and installing spark plugs			X					
VH-27	Timing the ignition			X					
VH-28	Inspecting and replacing circuit wiring, distributor cap and rotor			X					
VH-29	Testing, removing and replacing battery ignition components			X					
VH-30	Testing, removing and replacing electronic ignition components			X					
VH-31	Using and interpreting the ignition analyzer			X					
VH-32	Diagnosing ignition system problems			X					
VH-33	Servicing battery and cables			X					
	CARPENTRY								
C-01	Reading a rule			X			X		
C-02	Reading a scale			X			X		
C-03	Reading orthographic drawings			X			X		
C-04	Identifying elevations			X			X		
C-05	Identifying symbols			X			X		
C-06	Using hand tools (tooth cutting, edge cutting, boring, assembly and smoothing tools)			X			X		
C-07	Using measuring tools			X			X		
C-08	Using fasteners (nails, screws, glue)			X			X		
C-09	Using portable power tools (saws, drills, router and sanders)			X			X		
C-10	Surfacing stock, jointing edges and dressing lumber to thickness			X			X		
C-11	Ripping stock			X			X		
C-12	Cutting stock to length			X			X		
C-13	Using the band saw and scroll saw			X			X		
C-14	Using the shaper and overarm router			X			X		
C-15	Making wood joints			X			X		

COMPETENCY CHECKLIST

PROGRAM: INDUSTRIAL MAINTENANCE

STUDENT NAME:__________________________

				EXIT POINTS					
TASK NO.	UNIT COMPETENCIES	DATE	IN'T.	DOT NO. 633.281-014 JOB TITLE Maintenance Mechanic	600.280-042 Maintenance Machinist	825.281-014 Electrical Repairer	899.281-014 Maintenance Repairer	633.684-018 Maintenance Mechanic Helper	899.684-022 Maintenance Repairer Helper
C-16	Using the wood lathe to turn stock			X			X		
C-17	Boring holes and cutting plugs			X			X		
C-18	Sanding flat surfaces			X*			X*		

This is to certify that the above named student has demonstrated proficiency in the performance of the competencies and/or tasks indicated above. These competencies and/or tasks have been determined to be the skills and knowledge that are necessary for entry level employment into the job classifications indicated.

Date____________________ Instructor______________________

School______________________

Instructor______________________

Instructor______________________

Instructor______________________

Instructor______________________

*Certificate of Competency can be issued

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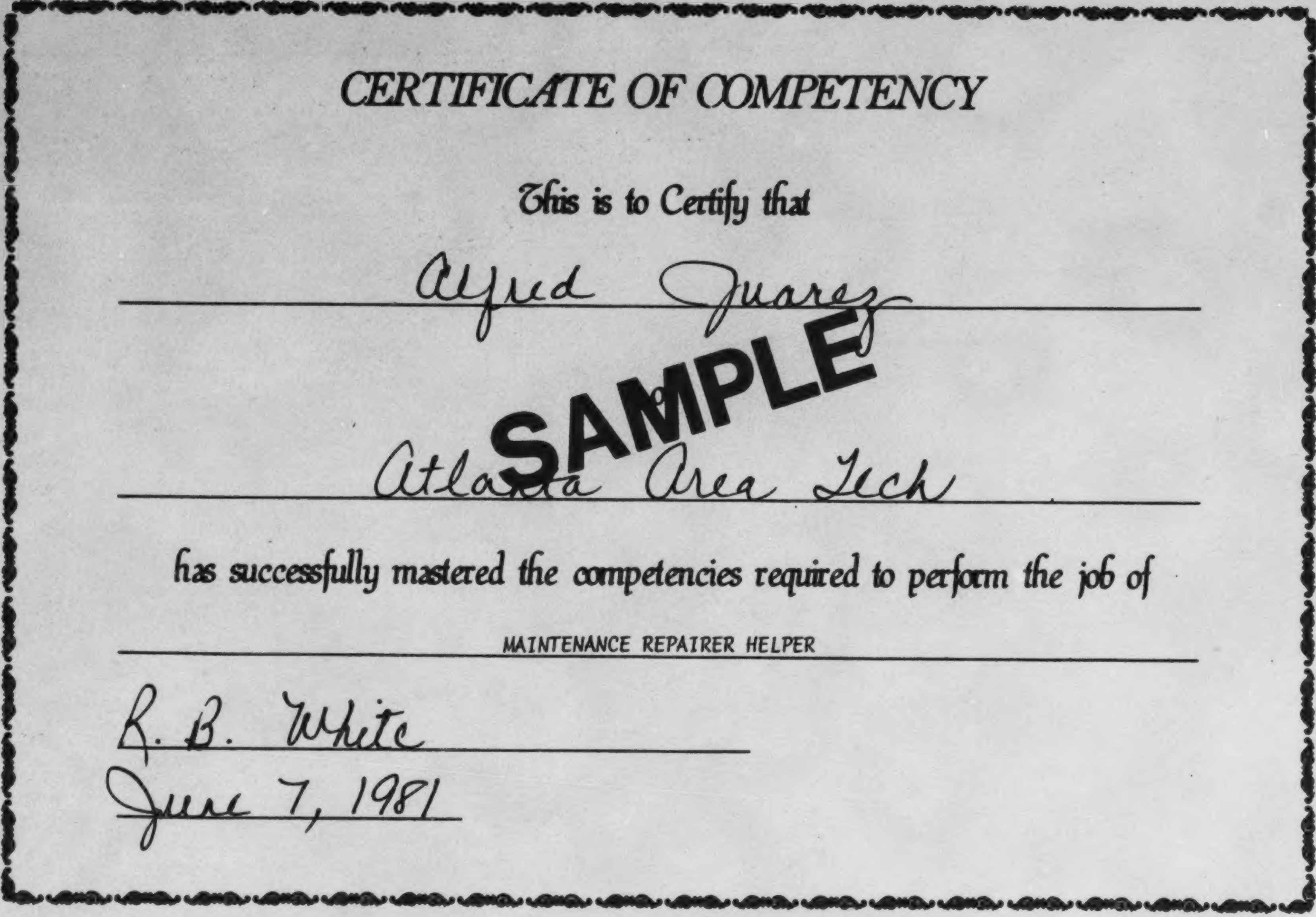

CERTIFICATE OF COMPETENCY

This is to Certify that

Alfred Juarez

[illegible]

SAMPLE

Atlanta Area Tech

has successfully mastered the competencies required to perform the job of

MAINTENANCE REPAIRER HELPER

R. B. White

June 7, 1981

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Repairer Helper.

MAINTENANCE REPAIRER HELPER
(D.O.T. Code 899.684-022)

Industrial Process and Maintenance

Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Identifying hydraulic and pneumatic drawings
Identifying and using wrenches and screwdrivers
Identifying and using pipefitting tools
Identifying and using plumbing tools
Identifying and using electrical tools
Identifying and using cement, plaster and glazing tools
Identifying and using woodworking tools
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication
Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying V-belt drives
Identifying chain drives
Identifying bearing seals
Identifying methods of bearing lubrication
Installing packings and maintaining pump seals
Identifying piping systems and piping system maintenance

Electrical Maintenance

Identifying basic electrical theory

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CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

MAINTENANCE MECHANIC
____

____

____

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Mechanic.

MAINTENANCE MECHANIC
(D.O.T. Code 638.281-014)

Industrial Process and Maintenance
Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Identifying hydraulic and pneumatic drawings
Using machine drawings in the maintenance of machinery and equipment
Reading building drawings
Reading electrical drawings
Reading pipe system drawings
Reading sheet metal drawings
Using shop math to interpret blueprints
Sketching schematic diagrams
Identifying types of schematics used in plant engineering
Identifying the symbols on electrical, piping and fluid power diagrams
Identifying guidelines for reading schematics
Identifying electrical diagrams
Identifying piping symbols
Reading piping schematics
Identifing fluid power symbols
Reading fluid power schematics
Identifying welding symbols
Identifying and using basic measuring tools
Identifying and using wrenches and screwdrivers
Identifying and using pipefitting tools
Identifying and using plumbing tools
Identifying and using electrical tools
Identifying and using cement, plaster and glazing tools
Identifying and using woodworking tools
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying work area safety precautions
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication

Grouping outlets onto branch circuits
Installing specific purpose outlets
Calculating branch circuit conductors and overcurrent protection
Installing branch circuits and controls for lighting
Selecting conduit
Installing conduit under a concrete slab
Installing outlet, junction and conduitlets
Installing branch circuits and controls for air conditioning and heating
Selecting and installing branch circuits for three phase water heaters
Planning and performing site work for a small industrial facility
Making calculations for electric motors, welders and heaters
Calculating the 120 and 277 volt lighting load
Calculating and selecting receptacles for 120/208 volt loads
Calculating size for and selecting and installing a Buss-Duct
Selecting and installing a three phase, four wire 480v panel
Selecting the correct transformer bank
Selecting and installing a 480v/280-120 three phase four wire service
Installing metering equipment
Selecting and installing panels and selecting distribution equipment
Selecting and installing a 277v flourescent light
Determining sizes and types of feeders and overcurrent protection devices
Installing a branch circuit for welders
Operating a split phase motor
Operating a capacitor start motor
Operating a universal motor
Operating a three phase induction motor
Operating a three phase synchronous motor
Operating a three phase, one winding, two speed motor
Operating a three phase, two winding, two speed motor
Operating single and three phase alternators
Operating an induction regulator
Operating a rotary frequency changer
Operating a synchronous rotary converter
Operating a rotary converter
Operating DC motors
Operating and checking load characteristics of DC generators

Carrying a puddle without a filler rod
Welding an outside corner joint without a filler rod
Making beads with filler rods
Welding butt joints
Welding lap joints
Welding T-joints
Setting up the oxyacetylene apparatus for flame cutting
Cutting with an oxyacetylene cutting torch
Piercing and cutting holes
Cutting with an automatic oxyacetylene cutting machine
Welding beads with brass rods
Brazing a lap joint using oxyacetylene apparatus
Brazing with silver
Soldering copper, sheet metal and other metals
Welding cast iron
Cutting and welding pipe

Shielded Arc Welding
Selecting and setting up shielded arc welding apparatus
Welding string and weave beads
Arc welding string beads and padding a plate
Arc welding lap joints
Arc welding butt joints
Shield arc welding T-fillet joints
Testing arc welded joints

Air Conditioning and Heating Maintenance
Identifying major components and functions of air conditioning systems
Applying basic air principles
Calculating heat loads
Applying principles of air movement
Servicing air filtering systems
Installing condensate drains
Installing residential and mobile home package air conditioning units
Installing split system air conditioning units
Installing add-on split air conditioning systems
Troubleshooting compressor burnout
Troubleshooting fans and fan motors
Performing pre-season start-up and air conditioner service
Troubleshooting air conditioner refrigeration cycle
Troubleshooting air conditioner electrical cycle

Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying lubrication systems and methods
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying common couplings
Identifying special couplings
Identifying clutches
Identifying V-belt drives
Identifying chain drives
Identifying speed reducers
Identifying gears
Identifying variable speed reducers
Identifying brakes and motors
Identifying principles of bearings and shafts
Identifying plan journal bearings
Identifying anti-friction bearings
Identifying ball and roller bearings
Identifying specialized bearings
Identifying bearing seals
Identifying methods of bearing lubrication
Maintaining bearings
Identifying pump application
Selecting a pump
Identifying centrifugal pumps
Identifying propeller and turbine pumps
Identifying rotary pumps
Identifying reciprocating pumps
Identifying metering pumps
Identifying special purpose pumps
Installing packings and maintaining pump seals
Performing pump maintenance
Identifying piping systems and piping system maintenance
Maintaining metal pipe
Maintaining non-metallic piping
Maintaining tubing
Maintaining hoses
Maintaining fittings
Maintaining common valves
Identifying specialized valves
Maintaining strainers, filters and traps
Maintaining pipeline by monitoring accessories
Identifying principles of hydraulics
Identifying hydraulic fluids
Identifying strainers and filters in hydraulic systems
Identifying reservoirs and accumulators in a hydraulic system
Identifying hydraulic pumps on a system
Identifying piping, tubing and fittings
Identifying directional control valves
Identifying pressure control valves
Identifying cylinders in a hydraulic system
Correcting power factors
Hooking up and operating gear motors
Selecting correct machine drive
Installing ventilator fans
Identifying motor leads
Identifying hazardous wiring locations
Operating a power actuated tool

Machine Shop
Laying out metal surfaces
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vises and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and fitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety
Identifying parts and functions of the drilling machine
Identifying safety practices and precautions when using the drilling machine
Identifying work-holding devices and set ups
Identifying and using drill bit holding devices
Identifying drill bits
Identifying cutting feeds and speeds
Identifying principles of straight drilling
Identifying and using coolants and cutting compounds
Grinding and caring of drills
Identifying and using twist drill gages
Identifying and using drill grinding machines
Identifying machine reamers
Performing machine reaming with the drilling machine
Identifying principles of boring and counterboring
Troubleshooting air conditioner movement

Heat Pumps
Applying principles of the heat pump
Evacuating and charging a heat pump
Installing a reversing valve
Tracing the heat pump refrigeration cycle
Installing electrical circuits
Adjusting and repairing defrost controls
Installing package heat pumps
Installing split-system heat pumps

Heating
Applying principles of electric furnaces and controls
Installing electric furnaces
Troubleshooting electric furnaces
Applying gas fuel combustion and safety principles
Identifying major components and functions of gas heating systems
Checking gas sources
Applying gas piping principles
Installing and adjusting gas regulators
Installing and servicing gas valves
Installing and servicing pilot ignition devices
Installing and servicing combination gas valves
Servicing gas burners
Inspecting and adjusting temperature rise of heat exchangers
Venting gas heating systems
Servicing gas furnace electrical controls
Determining combustion efficiency
Performing a pre-season check-up and start-up on a gas furnace
Troubleshooting the gas heating system
Identifying types of fuel oil and their principles of combustion
Designing and installing oil piping
Installing oil burners
Installing and servicing transformers and electrodes
Installing oil pumps
Servicing blower, nozzle, motor and coupling
Performing the combustion efficiency test
Installing controls
Performing pre-season start-up and check-up on an oil burning heating system
Troubleshooting the oil burning heating system

Sheet Metal
Identifying materials used in sheet metalwork
Developing sheet metal patterns
Cutting sheet metal
Bending sheet metal by hand
Bending metal on a bar folder or brake
Roll-forming sheet metal

Identifying hydraulic motors
Troubleshooting hydraulic systems using schematics
Reading hydraulic schematic diagrams
Installing hydraulic components
Installing pipes and tubes
Selecting hydraulic fluids
Planning system maintenance
Troubleshooting hydraulic systems (diagnostic technique)
Troubleshooting valves
Troubleshooting cylinders
Troubleshooting pumps and motors
Identifying pneumatic principles
Identifying reciprocating compressors
Identifying rotary compressors
Identifying primary air treatment in pneumatic systems
Identifying secondary air treatment methods
Identifying piping, hoses and fittings used in pneumatic systems
Identifying control valves
Identifying pressure relief valves
Identifying cylinders
Identifying motors
Identifying components of pneumatic systems
Reading pneumatic schematic diagrams
Installing system components
Identifying procedures for pneumatic system maintenance
Determining system failures
Troubleshooting air compressors
Troubleshooting control valves
Troubleshooting cylinders
Troubleshooting air motors
Troubleshooting pneumatic and hydraulic systems

Electrical Maintenance

Identifying basic electrical theory
Determining transformer polarity
Connecting to and operating dual voltage single phase transformers
Connecting single phase transformers in series
Connecting single phase transformers in parallel
Determining the DVA rating of single phase transformers
Determining the DVA rating of three phase transformers
Hooking up and operating a one phase auto transformer
Hooking up a one phase buck booster transformer
Hooking up a three phase transformer
Hooking up a three phase auto transformer
Hooking up a three phase transformer bank connected Wye/Wye
Hooking up a three phase transformer bank connected Delta/Delta

Using the drill press in spot facing operations
Performing counter sinking and center drilling operations
Identifying lathe safety
Identifying lathes
Identifying work-holding devices
Identifying cutting tools
Identifying measuring tools
Identifying lathe attachments
Calculating cutting feeds and speeds on the lathe
Determining RPM
Centering stock
Identifying principles of facing
Identifying principles of straight turning and turning to shoulders
Identifying chucks
Performing form turning operations
Identifying principles of faceplate work
Using draw-in collets
Identifying principles of drilling
Identifying machine reamers
Performing reaming operations on the engine lathe
Performing boring operations on the engine lathe
Identifying and using mandrels
Performing knurling operations on the engine lathe
Performing cutting off operations on the engine lathe
Identifying thread cutting devices
Identifying the parts of a thread
Identifying American National thread standards
Computing American National thread form
Computing sharp V-thread formulas
Identifying acme threads
Using the acme tap
Identifying square threads
Identifying classes of fits of screw threads
Using thread gages
Using a thread micrometer
Measuring threads using the three-wire method
Cutting threads with an even geared lathe
Cutting threads on a lathe which is not even geared
Cutting threads on a quick-change gear lathe
Identifying multiple lead screw threads
Cutting left hand threads
Determining a tap drill size
Cutting internal threads and performing tapping operation
Identifying principles of taper turning
Computing tapers
Measuring short tapers
Gaging inside and outside tapers
Tapering using the offset tailstock method

Making seams
Using the rotary machine
Fastening sheet metal

Vehicle Maintenance

Reading and interpreting the shop service manual
Identifying and maintaining shop tools and equipment
Using precision measurement tools and equipment
Demonstrating an understanding of engine theories of operation
Demonstrating a knowledge of electricity fundamentals
Demonstrating an understanding of fuels
Demonstrating an understanding of lubricants
Demonstrating an understanding of hardware and fasteners
Demonstrating basic metals operations
Demonstrating welding and soldering techniques

Automotive Systems Repair

Checking and changing engine oil and oil filter
Checking fluid level and refilling transmission and rear end
Lubricating chassis and components
Checking and replacing windshield wiper blades
Repairing tires and tubes
Replacing light bulbs and fuses
Washing and waxing vehicle
Adjusting fuel/air mixtures and mechanical linkage
Cleaning or replacing fuel air and air filters
Removing carburetor from engine
Disassembling, cleaning and inspecting carburetor
Reassembling and testing carburetor
Testing and replacing fuel pumps
Servicing fuel tank, lines, hoses and fuel level monitoring devices
Diagnosing fuel system problems
Inspecting, selecting and installing spark plugs
Timing the ignition
Inspecting and replacing circuit wiring, distributor cap and rotor
Testing, removing and replacing battery ignition components
Testing, removing and replacing electronic ignition components
Using and interpreting the ignition analyzer
Diagnosing ignition system problems
Servicing battery and cables

Carpentry

Reading a rule
Reading a scale

Hooking up a three phase bank of transformers open Delta
Hooking up a three phase transformer bank connected Wye/Delta
Hooking up a three phase transformer bank connected Delta/Wye
Hooking up a three phase transformer bank; reversed voltage
Hooking up transformers for special applications
Calculating service load for a small commercial building
Locating service entrance equipment and writing specifications
Selecting a service entrance conductor
Calculating service conduits
Installing service conduits
Installing service entrance conductors
Selecting and installing meters
Selecting and installing panels
Calculating and installing motor branch circuits
Installing and operating subfeeders and panels

Cutting a taper using the compound rest
Cutting a taper using the taper attachment
Boring or turning internal tapers
Identifying coolants and cutting compounds
Identifying lubricants

Welding

Identifying and using welding symbols
Using welding related shop tools
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

Oxyacetylene Welding, Cutting, Brazing and Soldering

Following safety procedures and regulations for oxyacetylene welding
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch

Reading orthographic drawings
Identifying elevations
Identifying symbols
Using hand tools (tooth cutting, edge cutting, boring, assembly and smoothing tools)
Using measuring tools
Using fasteners (nails, screws, glue)
Using portable power tools (saws, drills, router and sanders)
Surfacing stock, jointing edges and dressing lumber to thickness
Ripping stock
Cutting stock to length
Using the band saw and scroll saw
Using the shaper and overarm router
Making wood joints
Using the wood lathe to turn stock
Boring holes and cutting plugs
Sanding flat surfaces

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

MAINTENANCE MACHINIST

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Machinist.

MAINTENANCE MACHINIST
(D.O.T. Code 600.280-042)

Industrial Process and Maintenance

Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Using machine drawings in the maintenance of machinery and equipment
Reading sheet metal drawings
Using shop math to interpret blueprints
Sketching schematic diagrams
Identifying welding symbols
Identifying and using basic measuring tools
Identifying and using wrenches and screwdrivers
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying work area safety precautions
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication
Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying lubrication systems and methods
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying common couplings
Identifying special couplings
Identifying jig buttons
Using the sine bar
Using the bevel protractor
Using steel rules
Using the micrometer
Reading a vernier scale
Using dial indicators, center testers and speed indicators
Using precision gage blocks, tapered ring, plug and snap gages
Identifying and using hand hacksaws
Using abrasives and lapping compounds
Identifying and using files
Scraping flat and curved bearing surfaces
Using hammers and screwdrivers for hand bench use
Identifying and using wrenches
Using bench vises and clamps
Identifying and using chipping tools
Using hand taps, dies and hand reamers
Identifying power tool safety practices
Assembling and fitting
Identifying fasteners
Using thread, center, fillet and radius gages
Identifying lubricants and greases
Performing machine maintenance
Identifying bench work safety
Identifying parts and functions of the drilling machine
Identifying safety practices and precautions when using the drilling machine
Identifying work-holding devices and set ups
Identifying and using drill bit holding devices
Identifying drill bits
Identifying cutting feeds and speeds
Identifying principles of straight drilling
Identifying and using coolants and cutting compounds
Identifying measuring tools
Identifying lathe attachments
Calculating cutting feeds and speeds on the lathe
Determining RPM
Centering stock
Identifying principles of facing
Identifying principles of straight turning and turning to shoulders
Identifying chucks
Performing form turning operations
Identifying principles of faceplate work
Using draw-in collets
Identifying principles of drilling
Identifying machine reamers
Performing reaming operations on the engine lathe
Performing boring operations on the engine lathe
Identifying and using mandrels
Performing knurling operations on the engine lathe
Performing cutting off operations on the engine lathe
Identifying thread cutting devices
Identifying the parts of a thread
Identifying American National thread standards
Computing American National thread form
Computing sharp V-thread formulas
Identifying acme threads
Using the acme tap
Identifying square threads
Identifying classes of fits of screw threads
Using thread gages
Using a thread micrometer
Measuring threads using the three-wire method
Cutting threads with an even geared lathe
Cutting threads on a lathe which is not even geared

Identifying clutches
Identifying V-belt drives
Identifying chain drives
Identifying speed reducers
Identifying gears
Identifying brakes and motors
Identifying principles of bearings and shafts
Identifying plain journal bearings
Identifying anti-friction bearings
Identifying ball and roller bearings
Identifying specialized bearings
Identifying bearing seals
Identifying methods of bearing lubrication

Machine Shop

Laying out metal surfaces
Grinding and caring of drills
Identifying and using twist drill gages
Identifying and using drill grinding machines
Identifying machine reamers
Performing machine reaming with the drilling machine
Identifying principles of boring and counter-boring
Using the drill press in spot facing operations
Performing counter sinking and center drilling operations
Identifying lathe safety
Identifying lathes
Identifying work-holding devices
Identifying cutting tools
Cutting threads on on a quick-change gear lathe
Identifying multiple lead screw threads
Cutting left hand threads
Determining a tap drill size
Cutting internal threads and performing tapping operation
Identifying principles of taper turning
Computing tapers
Measuring short tapers
Gaging inside and outside tapers
Tapering using the offset tailstock method
Cutting a taper using the compound rest
Cutting a taper using the taper attachment
Boring or turning internal tapers
Identifying coolants and cutting compounds
Identifying lubricants

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CERTIFICATE OF COMPETENCY

This is to Certify that

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of

____

has successfully mastered the competencies required to perform the job of

ELECTRICAL REPAIRER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Electrical Repairer.

ELECTRICAL REPAIRER
(D.O.T. Code 825.281-014)

Industrial Process and Maintenance

Reading electrical drawings
Sketching schematic diagrams
Identifying types of schematics used in plant engineering
Identifying guidelines for reading schematics
Identifying electrical diagrams
Identifying piping symbols
Identifying and using wrenches and screwdrivers
Identifying and using electrical tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying work area safety precautions
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Maintaining non-metallic piping
Maintaining tubing
Maintaining hoses
Maintaining fittings
Maintaining common valves
Identifying specialized valves
Maintaining strainers, filters and traps
Maintaining pipeline by monitoring accessories
Identifying principles of hydraulics
Identifying hydraulic fluids
Identifying strainers and filters in hydraulic systems
Identifying reservoirs and accumulators in a hydraulic system
Identifying hydraulic pumps on a system
Identifying piping, tubing and fittings
Identifying directional control valves
Identifying pressure control valves
Identifying cylinders in a hydraulic system
Identifying hydraulic motors
Troubleshooting hydraulic systems using schematics
Identifying control valves
Identifying pressure relief valves
Identifying cylinders
Identifying motors
Identifying components of pneumatic systems
Reading pneumatic schematic diagrams
Installing system components
Identifying procedures for pneumatic system maintenance
Determining system failures
Troubleshooting air compressors
Troubleshooting control valves
Troubleshooting cylinders
Troubleshooting air motors
Troubleshooting pneumatic and hydraulic systems

Electrical Maintenance

Identifying basic electrical theory
Determining transformer polarity
Connecting to and operating dual voltage single phase transformers
Connecting single phase transformers in series
Connecting single phase transformers in parallel
Determining the KVA rating of single phase transformers
Determining the KVA rating of three phase transformers
Hooking up and operating a one phase auto transformer
Hooking up a one phase buck booster transformer
Hooking up a three phase transformer
Hooking up a three phase auto transformer
Hooking up a three phase transformer bank connected Wye/Wye
Hooking up a three phase transformer bank connected Delta/Delta
Hooking up a three phase bank of transformers open Delta
Hooking up a three phase transformer bank connected Wye/Delta
Hooking up a three phase transformer bank connected Delta/Wye
Grouping outlets onto branch circuits
Installing specific purpose outlets
Calculating branch circuit conductors and overcurrent protection
Installing branch circuits and controls for lighting
Selecting conduit
Installing conduit under a concrete slab
Installing outlet, junction and conduitlets
Installing branch circuits and controls for air conditioning and heating
Selecting and installing branch circuits for three phase water heaters
Planning and performing site work for a small industrial facility
Making calculations for electric motors, welders and heaters
Calculating the 120 and 277 volt lighting load
Calculating and selecting receptacles for 120/208 volt loads
Calculating size for and selecting and installing a Buss-Duct
Selecting and installing a three phase, four wire 480v panel
Selecting the correct transformer bank
Selecting and installing a 480v/280-120 three phase four wire service
Installing metering equipment
Selecting and installing panels and selecting distribution equipment
Selecting and installing a 277v flourescent light
Determining sizes and types of feeders and overcurrent protection devices
Installing a branch circuit for welders
Operating a split phase motor
Operating a capacitor start motor
Operating a universal motor
Operating a three phase induction motor
Operating a three phase synchronous motor
Operating a three phase, one winding, two speed motor

Reading hydraulic schematic diagrams
Installing hydraulic components
Installing pipes and tubes
Selecting hydraulic fluids
Planning system maintenance
Troubleshooting hydraulic systems (diagnostic technique)
Troubleshooting valves
Troubleshooting cylinders
Troubleshooting pumps and motors
Identifying pneumatic principles
Identifying reciprocating compressors
Identifying rotary compressors
Identifying primary air treatment in pneumatic systems
Identifying secondary air treatment methods
Identifying piping, hoses and fittings used in pneumatic systems

Hooking up a three phase transformer bank; reversed voltage
Hooking up transformers for special applications
Calculating service load for a small commercial building
Locating service entrance equipment and writing specifications
Selecting a service entrance conductor
Calculating service conduits
Installing service conduits
Installing service entrance conductors
Selecting and installing meters
Selecting and installing panels
Calculating and installing motor branch circuits
Installing and operating subfeeders and panels

Operating a three phase, two winding, two speed motor
Operating single and three phase alternators
Operating an induction regulator
Operating a rotary frequency changer
Operating a synchronous rotary converter
Operating a rotary converter
Operating DC motors
Operating and checking load characteristics of DC generators
Correcting power factors
Hooking up and operating gear motors
Selecting correct machine drive
Installing ventilator fans
Identifying motor leads
Identifying hazardous wiring locations
Operating a power actuated tool

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

____

has successfully mastered the competencies required to perform the job of

MAINTENANCE MECHANIC HELPER

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The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Mechanic Helper.

MAINTENANCE MECHANIC HELPER

(D.O.T. Code 633.684-018)

Industrial Process and Maintenance

Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Identifying hydraulic and pneumatic drawings
Identifying and using wrenches and screwdrivers
Identifying and using pipefitting tools
Identifying and using plumbing tools
Identifying and using electrical tools
Identifying and using cement, plaster and glazing tools
Identifying and using woodworking tools
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication
Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying V-belt drives
Identifying chain drives
Identifying bearing seals
Identifying methods of bearing lubrication
Installing packings and maintaining pump seals
Identifying piping systems and piping system maintenance

Electrical Maintenance

Identifying basic electrical theory

CERTIFICATE OF COMPETENCY

This is to Certify that

____

of

____

has successfully mastered the competencies required to perform the job of

MAINTENANCE REPAIRER
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____

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Repairer.

MAINTENANCE REPAIRER

(D.O.T. Code 899.261-014)

Industrial Process and Maintenance

Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Identifying hydraulic and pneumatic drawings
Identifying and using wrenches and screwdrivers
Identifying and using pipefitting tools
Identifying and using plumbing tools
Identifying and using electrical tools
Identifying and using cement, plaster and glazing tools
Identifying and using woodworking tools
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying work area safety precautions
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication
Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying common couplings
Identifying special couplings
Identifying clutches
Identifying V-belt drives
Identifying chain drives
Identifying speed reducers
Identifying gears
Identifying variable speed reducers
Identifying brakes and motors
Identifying principles of bearings and shafts
Identifying plain journal bearings
Identifying anti-friction bearings
Identifying ball and roller bearings
Identifying specialized bearings
Identifying bearing seals
Identifying methods of bearing lubrication
Maintaining bearings
Identifying pump application
Selecting a pump
Identifying centrifugal pumps
Identifying propeller and turbine pumps
Identifying rotary pumps
Identifying reciprocating pumps
Identifying metering pumps
Identifying special purpose pumps
Installing packings and maintaining pump seals
Performing pump maintenance
Identifying piping systems and piping system maintenance
Maintaining metal pipe

Electrical Maintenance

Identifying basic electrical theory
Determining transformer polarity
Installing and operating subfeeders and panels

Carpentry

Reading a rule
Reading a scale
Reading orthographic drawings
Identifying elevations
Identifying symbols
Using hand tools (tooth cutting, edge cutting boring, assembly and smoothing tools)
Using measuring tools
Using fasteners (nails, screws, glue)
Using portable power tools (saws, drills, router and sanders)
Surfacing stock, jointing edges and dressing lumber to thickness
Ripping stock
Cutting stock to length
Using the band saw and scroll saw
Using the shaper and overarm router
Making wood joints
Using the wood lathe to turn stock
Boring holes and cutting plugs
Sanding flat surfaces

CERTIFICATE OF COMPETENCY

This is to Certify that

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of

____

has successfully mastered the competencies required to perform the job of

MAINTENANCE REPAIRER HELPER

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____

The student named on this certificate has demonstrated mastery of the following unit level competencies required to perform the job of Maintenance Repairer Helper.

MAINTENANCE REPAIRER HELPER
(D.O.T. Code 899.684-022)

Industrial Process and Maintenance
Identifying basic principles of blueprint reading
Identifying elements of machine drawings
Identifying hydraulic and pneumatic drawings
Identifying and using wrenches and screwdrivers
Identifying and using pipefitting tools
Identifying and using plumbing tools
Identifying and using electrical tools
Identifying and using cement, plaster and glazing tools
Identifying and using woodworking tools
Identifying and using sheet metal tools
Identifying and using metalworking tools
Identifying and using hoisting and pulling tools
Identifying plant safety procedures
Observing safety precautions for tools and equipment
Identifying machinery safeguards
Observing safety in handling materials
Identifying fire prevention procedures
Handling hazardous materials
Observing electrical safety precautions
Identifying personal protection gear
Identifying basic principles of lubrication
Identifying characteristics of lubricants
Identifying additives, lubricating action and bearing lubrication
Identifying oils and their applications
Identifying general purpose greases
Identifying special purpose greases
Identifying lubricating compounds
Identifying automatic lubrication methods
Identifying methods of lubricant storage and handling
Identifying V-belt drives
Identifying chain drives
Identifying bearing seals
Identifying methods of bearing lubrication
Installing packings and maintaining pump seals
Identifying piping systems and piping system maintenance

Electrical Maintenance
Identifying basic electrical theory

	UNITS/TASKS																				
NAME																					

SECTION VI

FACILITIES

SECTION VI

Section VI Content List

Group Instruction Facilities
Individualized Instruction Facilities

The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The school administration and program instructor must determine an arrangement that best fits the needs of the students by determining the most efficient use of resources available to them not only in the laboratory, but also in the Learning Resource Center settings.

FACILITY LAYOUTS

The layouts on the following pages illustrate how facilities for group and individualized instructional programs may be planned and set up.

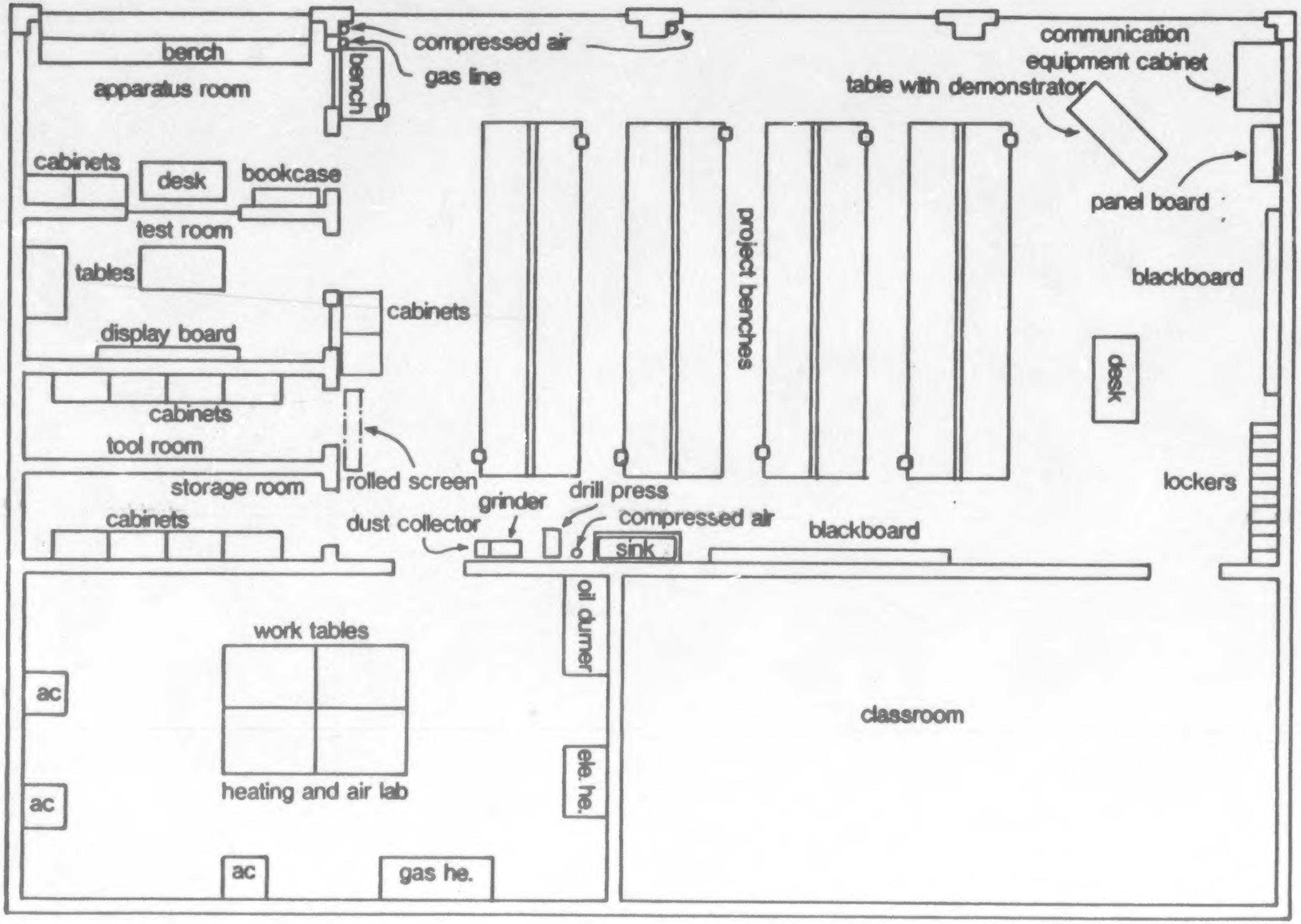
Each instructional approach has two important physical areas. These are (1) the laboratory (work) area and classroom for group instruction and (2) the laboratory (work) area and learning resource center (LRC) for individualized instruction.

The instructional setting for group instruction is based on that of a traditional classroom. This approach is easily set up and includes little or no modifications. The primary modes of learning are instructor lectures, occasional use of audiovisual aids and student participation. Ideally, all students progress at the same pace.

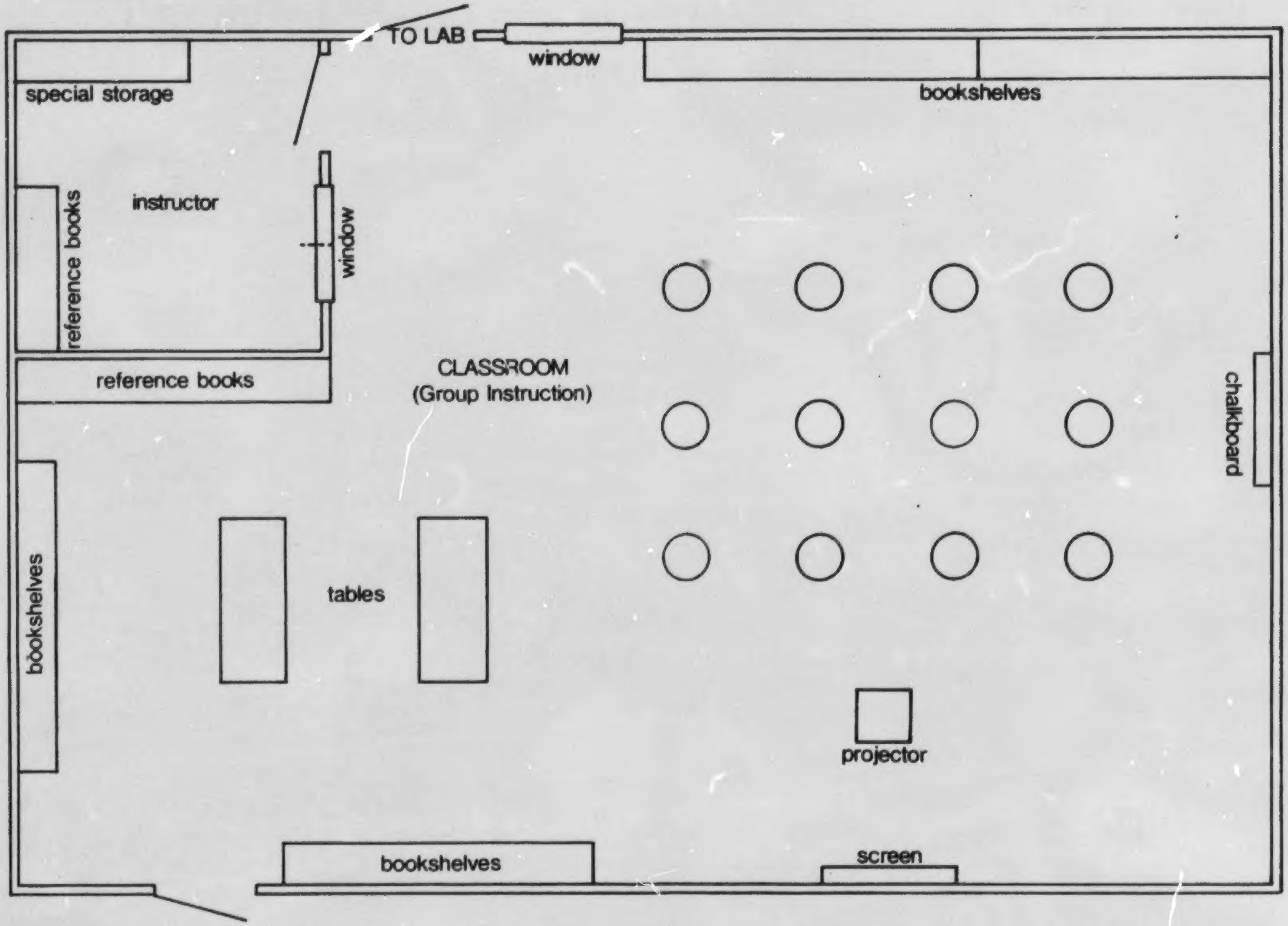
The instructional setting for individual instruction is designed to facilitate a student self-paced progression of learning. The LRC requires careful planning in utilizing available space. When planning to install an individual instruction program in an area not originally designed for this approach, the instructional setting may need modifications. Desks may be replaced with study carrels to allow students to simultaneously participate in a variety of learning activities. A group session area for small group gatherings should also be included. Because the instructor and students rarely meet together as a group, a bulletin board becomes a vital communication device in an LRC. It can be used to post announcements and such instructional information as group progress charts, assignments, positions available in the industry and safety rules.

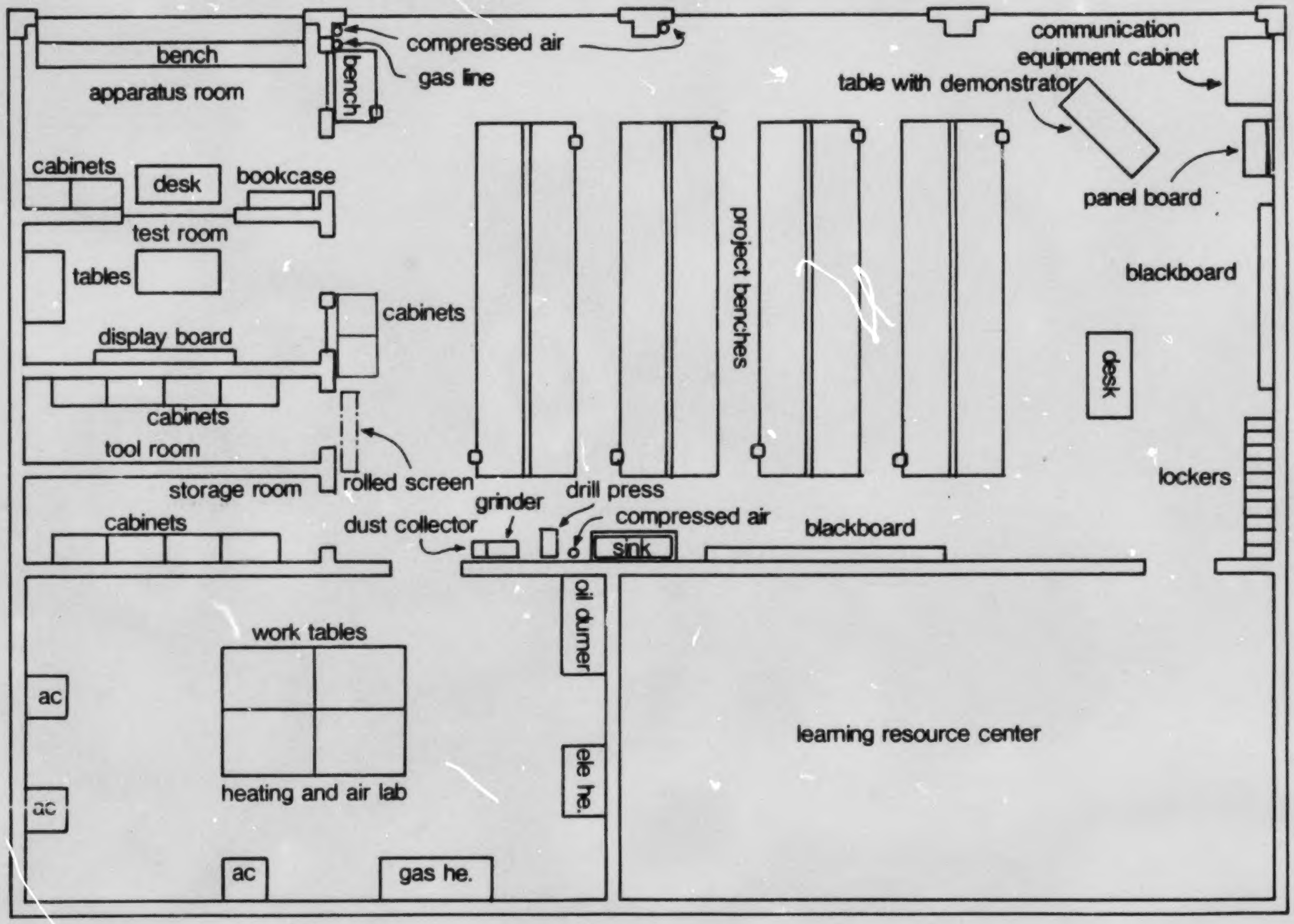
A variety of references, resources and media equipment should be made available to the student. Therefore, an adequate amount of storage area should be included in planning the LRC. Every specific school and department has unique physical layout characteristics and problems. Through innovation, these features may be transformed into LRC advantages rather than disadvantages.

The manner in which the laboratory (work) area is planned and set up need not be affected by the type of instructional approach used by an instructor; it could/will be the same. Some major concerns in the laboratory are: 1) the instructor must always have a clear line of sight to each and every workstation, 2) tools must be accessible to students, but under the control of the instructor and 3) all supplies and materials required for the day's activities must be on hand and ready to use.


bench
bench
apparatus room
compressed air
gas line
communication equipment cabinet
table with demonstrator
cabinets
desk
bookcase
test room
tables
display board
cabinets
project benches
panel board
blackboard
desk
cabinets
tool room
rolled screen
storage room
cabinets
lockers
grinder
drill press
dust collector
compressed air
sink
blackboard
oil durner
work tables
ac
ac
ac
heating and air lab
ele. he.
gas he.
classroom

VI-7


TO LAB
window
special storage
bookshelves
instructor
reference books
window
reference books
CLASSROOM
(Group Instruction)
chalkboard
bookshelves
tables
projector
screen
bookshelves


bench
apparatus room
bench
compressed air
gas line
communication equipment cabinet
table with demonstrator
cabinets
desk
bookcase
test room
tables
panel board
project benches
blackboard
cabinets
display board
desk
cabinets
tool room
rolled screen
storage room
lockers
grinder
drill press
cabinets
dust collector
compressed air
sink
blackboard
oil durner
work tables
ac
learning resource center
ele he.
ac
heating and air lab
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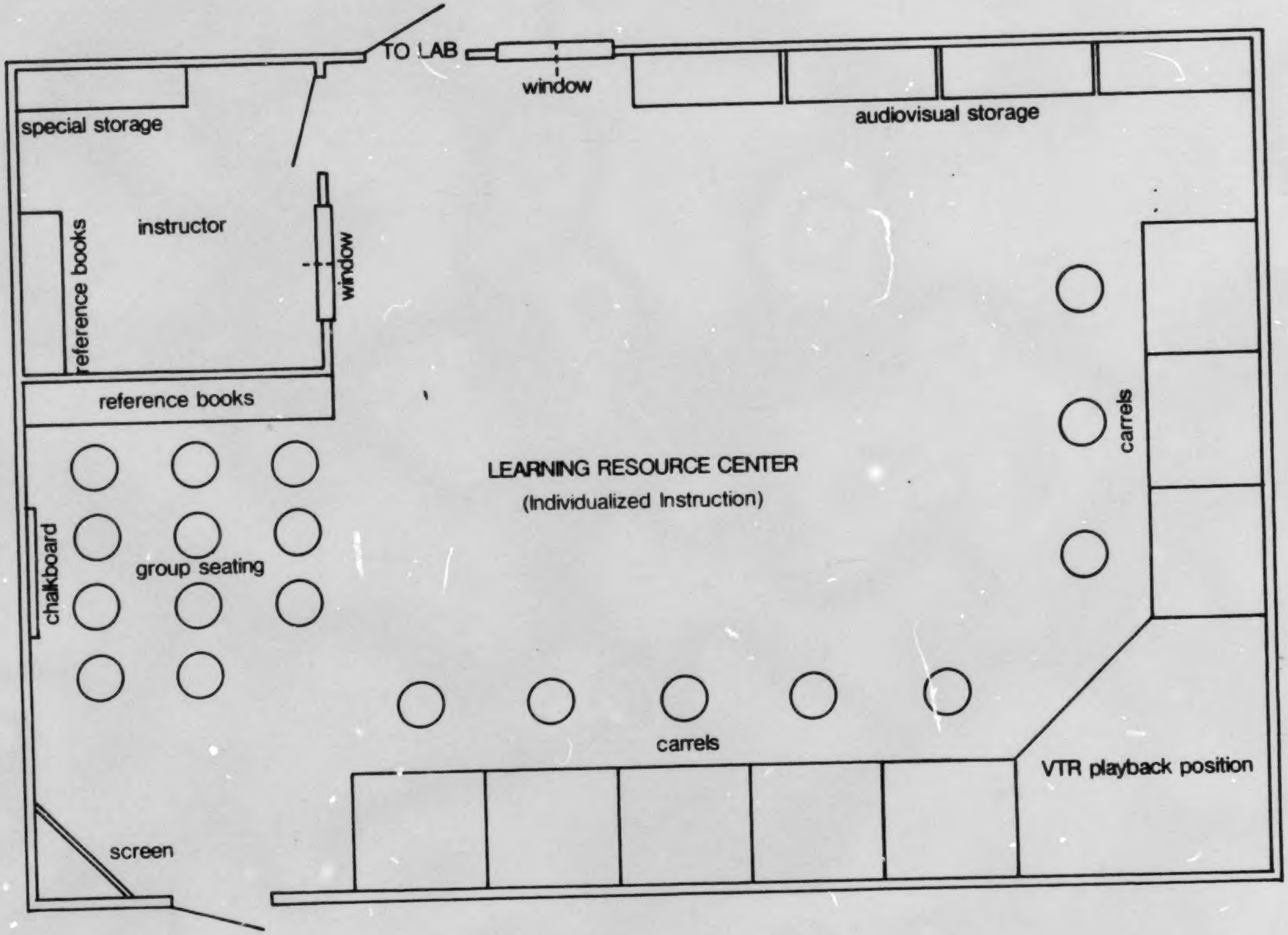
gas he.


TO LAB
window
special storage
audiovisual storage
instructor
reference books
window
reference books
LEARNING RESOURCE CENTER
(Individualized Instruction)
carrels
chalkboard
group seating
carrels
VTR playback position
screen

APPENDIX A

Resources

RESOURCES

This appendix contains the instructional resource matrix, unit guide references and additional instructional materials.

The instructional resource matrix lists the audiovisuals, textbooks and student manuals for each task referenced on unit guide sheets. The audiovisual format is identified by symbols such as: filmstrip (FS), slide/script (SS), slide/tape (ST), 16mm movie film (MF), transparency (TR), video tape (VT) and filmloop (FL). The producer and title of the A/V is also given.

The unit guide bibliography lists textbooks, audiovisuals and student manuals cited in the unit guides section.

The additional instructional materials is a compilation of textbooks not included in the unit guides but beneficial to educators.

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-01	Identifying basic principles of blueprint reading	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines, Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson One
IPM-02	Identifying elements of machine drawings	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines: Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Two
IPM-03	Identifying hydraulic and pneumatic drawings		Pease: Basic Fluid Power	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Three
IPM-04	Using machine drawings in the maintenance of machinery and equipment	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines: Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Four
IPM-05	Reading blueprint drawings	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines: Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Five
IPM-06	Reading electrical drawings	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines, Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Six
IPM-07	Reading pipe system drawings		Pease: Basic Fluid Power	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Seven
IPM-08	Reading sheet metal drawings	Career Aids, Inc.: "Sheet Metal Work Explained," (FS)	Feirer: General Metals; Walker: Modern Metal-Working	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Eight

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-15	Reading electrical diagrams		Howard W. Sams & Co.: How to Read Schematic Diagrams	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Five
IPM-16	Identifying piping symbols	Career Aids, Inc.: "Drafting and Blueprint Reading," (TR/T)	Morrow: Maintenance Engineering Handbook; Willis: Blueprint Reading for Commercial Construction	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Six
IPM-17	Reading piping schematics		Willis: Blueprint Reading for Commercial Construction	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Seven; Oregon: Symbols; Oregon: Basic Symbols
IPM-18	Identifying fluid power symbols	Howard W. Sams & Co.: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Eight
IPM-19	Reading fluid power schematics		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Nine
IPM-20	Identifying welding symbols	Hobar: "Blueprint Reading for Welders," (TR)	Griffin and Roden: Welding Processes	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Ten
IPM-21	Identifying and using basic measuring tools	Hobar: "Micrometers, Calipers and Gages," (TR); Hobar: "Reading the Micrometers," (TR); DCA Educational Products: "Precision Products," (TR)	Dover Publications: Tools and Their Uses; Hinrichs: Measuring	Plant Engineering Training Systems: Hand Tools, Lesson One

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-09	Using shop math to interpret blueprints		Delmar: Mathematics for the Shop; Hobar: Practical Problems in Math Series	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Nine
IPM-10	Sketching schematic diagrams	Career Aids, Inc.: "Drafting and Blueprint Reading Series," (TR/T)	Willis: Blueprint Reading for Commercial Construction; Jensen and Hines: Interpreting Engineering Drawings	Plant Engineering Training Systems: Basic Blueprint Reading, Lesson Ten
IPM-11	Identifying types of schematics used in plant engineering	Career Aids, Inc.: "Basic Electricity and Electronics Explained," (FS)	Morrow: Plant Engineering Handbook; Smith: Electricity for Refrigeration, Heating and Air Conditioning	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson One
IPM-12	Identifying the symbols on electrical, piping and fluid power diagrams	Career Aids, Inc.: "Basic Electricity and Electronics Explained," (FS)	Morrow: Plant Engineering Handbook; Bobbs-Merrill: Industrial Electronic Systems; Howard W. Sams & Co., Inc.: Collected Basic Circuits	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Two
IPM-13	Identifying guidelines for reading schematics		Smith: Electricity for Refrigeration, Heating and Air Conditioning; Morrow: Maintenance Engineering Handbook	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Three
IPM-14	Identifying electrical symbols		Loper and Ahr: Electricity and Electronics; Delmar: Electronics, Electricity, Electro-Mechanical Technology; Howard W. Sams & Co.: How to Read a Schematic Diagram	Plant Engineering Training Systems: Reading Schematics and Symbols, Lesson Four

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-22 Identifying and using wrenches and screwdrivers	Hobar: "Screwdrivers," (TR); DCA: "Screwdrivers," (TR)	Dover Publications: Tools and Their Uses; Hobar: Screwdrivers	Plant Engineering Training Systems: Hand Tools, Lesson Two
IPM-23 Identifying and using pipefitting tools	Hobar: "Laboratory Exercise in Pipefitting," (ST)	Dover Publications; Tools and Their Uses	Plant Engineering Training Systems: Hand Tools, Lesson Three
IPM-24 Identifying and using plumbing tools		Dover Publications: Tools and Their Uses; Audel: Plumbers and Pipefitter's Library	Plant Engineering Training Systems: Hand Tools, Lesson Four; MAVCC: Residential Plumbing
IPM-25 Identifying and using electrical tools	Hobar: "Housewiring," (FS)	AAVIM: Electrical Wiring	Plant Engineering Training Systems: Hand Tools, Lesson Five
IPM-26 Identifying and using cement, plaster and glazing tools	Hobar: "MTR-II," (TR); Hobar: "MTR-IV," (TR); Hobar: "MTR-V," (TR): Hobar: "MTR-III," (TR)	White: Concrete Technology; Moore: Concrete Form Construction; Smith: Principles and Practices of Heavy Construction; NAVTRA: Builder I & C; Prentice-Hall: Masonry and Concrete	Plant Engineering Training Systems: Hand Tools, Lesson Six
IPM-27 Identifying and using woodworking tools	Prentice-Hall: "XF-1121," (FS/CT); Prentice-Hall: "XF-1120," (FS/CT); Hobar: "Hammers, Nails and Nailing Techniques," (ST); Hobar: "Transparencies," (TR); Bergwall: "Woodworking Handtools Explained," (FS)	Reed: Residential Carpentry; NAVTRA: Builder I & C; Dover Publications: Tools and Their Uses	Plant Engineering Training Systems: Hand Tools, Lesson Seven

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-28	Identifying and using sheet metal tools	Hobar: "Sheet Metal Hand Tools," (TR); Bergwall: "Sheet Metal Work," (FS)	Ludwig and McCarthy: Metal Work Technology and Practice; Walker: Modern Metal-Working	Plant Engineering Training Systems; Hand Tools, Lesson Eight; California State Department of Education: Sheet Metal Tools and Equipment Workbook
IPM-29	Identifying and using metalworking tools		Ludwig and McCarthy: Metal Work and Technology and Practice; Walker: Modern Metal-Working	Plant Engineering Training Systems: Hand Tools, Lesson Nine
IPM-30	Identifying and using hoisting and pulling tools		Morrow: Maintenance Engineering Handbook	Plant Engineering Training Systems: Hand Tools, Lesson Ten
IPM-31	Identifying plant safety	AAVIM: "Developing Shop Safety," (ST); Career Aids, Inc.: "Safetitudes," (FS); Career Aids, Inc.: "General Shop Safety," (FS)	AAVIM: Developing Shop Safety	Plant Engineering Training Systems: Plant Safety, Lesson One; AAVIM: Developing Shop Safety Skills
IPM-32	Observing safety precautions for tools and equipment	Hobar: Slide Sets SMP-II, SMP-III and SMP-IV, (SS); Hobar: "Power Tool Safety and Operation," (TR); Career Aids, Inc.: "Using Hand Tools Parts 1 and 2," (TR); Career Aids, Inc.: "Using Power Tools," (TR)		Plant Engineering Training Systems: Plant Safety, Lesson Four; Hobar: Power Tool Safety and Operation
IPM-33	Identifying machinery safeguards	Hobar: "Power Tool Safety and Operation," (TR)		Plant Engineering Training Systems: Plant Safety, Lesson Five; Hobar: Power Tool Safety and Operation

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-34 Observing safety in handling materials	Career Aids, Inc.: "Lift With Your Head," (FS)		Plant Engineering Training Systems: Plant Safety, Lesson Three
IPM-35 Identifying work area safety precautions	Career Aids, Inc.: "Safety at Work," (FS)		Plant Engineering Training Systems: Plant Safety, Lesson Two
IPM-36 Identifying fire prevention procedures	Career Aids, Inc.: "School Shop Safety," (FS)	Colburn: Fire Protection and Supression	Plant Engineering Training Systems: Plant Safety, Lesson Nine
IPM-37 Handling hazardous materials	Career Aids, Inc.: "Safety at Work." (FS)	Anton: Occupational Safety and Health Management	Plant Engineering Training Systems; Plant Safety, Lesson Eight
IPM-38 Observing electrical safety precautions	Career Aids, Inc.: "Electrical Safety in the Shop," (FS); Career Aids, Inc.: "Electricity/Electronics," (FS)		Plant Engineering Training Systems: Plant Safety, Lesson Seven
IPM-39 Identifying personal protection gear	University of Missouri: "Safety in Trade and Industrial Education," (ST)	University of Missouri: Safety in Trade and Industrial Education	Plant Engineering Training Systems: Plant Safety, Lesson Six
IPM-40 Identifying basic principles of lubrication	DCA: "Lubricants," (ST)	McGraw-Hill: Standard Handbook of Lubrication	Plant Engineering Training Systems: Lubrication, Lesson One
IPM-41 Identifying characteristics of lubricants		McGraw-Hill: Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems, Lubrication, Lesson Two

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-42 Identifying additives, lubricating action and bearing lubrication		McGraw-Hill; Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Three
IPM-43 Identifying oils and their applications		McGraw-Hill; Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Four
IPM-44 Identifying general purpose greases		McGraw-Hill: Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Five
IPM-45 Identifying special purpose greases		McGraw-Hill: Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Six
IPM-46 Identifying lubricating compounds		McGraw-Hill: Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Seven
IPM-47 Identifying lubrication systems and methods			Plant Engineering Training Systems: Lubrication, Lesson Eight
IPM-48 Identifying automatic lubrication methods			Plant Engineering Training Systems: Lubrication, Lesson Nine
IPM-49 Identifying methods of lubricant storage and handling		McGraw-Hill: Standard Handbook of Lubrication Engineering	Plant Engineering Training Systems: Lubrication, Lesson Ten
IPM-50 Identifying common couplings		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson One

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-51	Identifying special couplings		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Two
IPM-52	Identifying clutches		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Clutches, Lesson Three
IPM-53	Identifying V-belt drives		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Four
IPM-54	Identifying chain drives		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Five
IPM-55	Identifying speed reducers		Delmar; Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Six; Plant Engineering Training Systems: Drive Components, Lesson Seven
IPM-56	Identifying gears		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Eight
IPM-57	Identifying variable speed reducers		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Nine
IPM-58	Identifying brakes and motors		Delmar: Electromechanical Technology Series, Drives	Plant Engineering Training Systems: Drive Components, Lesson Ten

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-59 Identifying principles of bearings and shafts		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson One
IPM-60 Identifying plain journal bearings		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Two; Plant Engineering Training Systems: Bearings, Lesson Three
IPM-61 Identifying antifriction bearings		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Four; Plant Engineering Training Systems: Bearings, Lesson Five
IPM-62 Identifying ball and roller bearings		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Six
IPM-63 Identifying specialized bearings		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Seven
IPM-64 Identifying bearing seals		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Eight
IPM-65 Identifying methods of bearing lubrication		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Nine

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-66 Maintaining bearings		McGraw-Hill: Maintenance Engineering Handbook	Plant Engineering Training Systems: Bearings, Lesson Ten
IPM-67 Identifying pump application		Howard W. Sams and Co., Inc.: Pumps	Plant Engineering Training Systems: Pumps, Lesson One
IPM-68 Selecting a pump		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Two
IPM-69 Identifying centrifugal pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Three
IPM-70 Identifying propeller and turbine pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Four
IPM-71 Identifying rotary pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Five
IPM-72 Identifying reciprocating pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Six
IPM-73 Identifying metering pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Seven
IPM-74 Identifying special purpose pumps		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Eight
IPM-75 Installing packings and maintaining pump seals		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Nine

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-76 Performing pump maintenance		Black: Pumps	Plant Engineering Training Systems: Pumps, Lesson Ten
IPM-77 Identifying piping systems and piping system maintenance		Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson One
IPM-78 Maintaining metal pipe	Hobar: "Basic Plumbing Skills," (FS)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Two
IPM-79 Maintaining nonmetallic piping	Hobar: "Laboratory Exercises in Pipefitting," (ST)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Three
IPM-80 Maintaining tubing	Hobar: "Laboratory Exercises in Pipe Fitting," (ST)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Four
IPM-81 Maintaining hoses		Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Five
IPM-82 Maintaining fittings	Hobar: "Laboratory Pipefitting," (ST)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Six

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-83	Maintaining common valves	Hobar: "Laboratory Exercises in Pipefitting," (ST)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training System: Piping Systems, Lesson Seven
IPM-84	Identifying specialized valves		Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Eight
IPM-85	Maintaining strainers, filters and traps	Hobar: "Laboratory Exercises in Pipefitting," (ST)	Audel: Plumber's and Pipefitter's Library; ATS: How to Design and Install Plumbing	Plant Engineering Training Systems: Piping Systems, Lesson Nine
IPM-86	Maintaining pipeline by monitoring accessories		Audel: Plumber's and Pipefitter's Library	Plant Engineering Training Systems: Piping Systems, Lesson Ten
IPM-87	Identifying principles of hydraulics	Howard W. Sams and Co.: "Fluid Power," (TR)	Pease: Basic Fluid Power; Howard W. Sams and Co.: ABC's of Hydraulic Circuits; Pippenger and Hicks: Industrial Hudraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson One
IPM-88	Identifying hydraulic fluids		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Examples of types of hydraulic fluid

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-89 Identifying strainers and filters in hydraulic systems		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Three
IPM-90 Identifying reservoirs and accumulators in a hydraulic system		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Four; Oregon: Reservoirs
IPM-91 Identifying hydraulic pumps on a system		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Five; Oregon: Pumps
IPM-92 Identifying piping, tubing and fittings		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics: Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Six
IPM-93 Identifying directional control valves		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Seven; Oregon: Directional Control Valve

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-94 Identifying pressure control valves		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Eight; Oregon: Pressure Relief Valves
IPM-95 Identifying cylinders in a hydraulic system		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Morrow: Maintenance Engineering Handbook; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems; Basic Hydraulics; Lesson Nine; Oregon: Cylinders
IPM-96 Identifying hydraulic motors		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics; Morrow: Maintenance Engineering Handbook; Delmar: Electromechanical Technology Series, Fluids	Plant Engineering Training Systems: Basic Hydraulics, Lesson Ten
IPM-97 Troubleshooting hydraulic systems using schematics		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson One
IPM-98 Reading hydraulic schematic diagrams		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Two
IPM-99 Installing hydraulic components		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Three

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
IPM-100	Installing pipes and tubes		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Four
IPM-101	Selecting hydraulic fluids		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics: Morrow: Maintenance Engineering Handbook	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Five
IPM-102	Planning system maintenance		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Six
IPM-103	Troubleshooting hydraulic systems (diagnostic techniques)		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Seven
IPM-104	Troubleshooting valves		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Eight
IPM-105	Troubleshooting cylinders		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Nine
IPM-106	Troubleshooting pumps and motors		Pease: Basic Fluid Power; Pippenger and Hicks: Industrial Hydraulics	Plant Engineering Training Systems: Hydraulic Troubleshooting, Lesson Ten
IPM-107	Identifying pneumatic principles	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson One; Bobbs-Merrill: Fluid Power

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-108 Identifying reciprocating compressors	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Two; Bobbs-Merrill: Fluid Power
IPM-109 Identifying rotary compressors	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Three; Bobbs-Merrill: Fluid Power
IPM-110 Identifying primary air treatment in pneumatic systems	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Four; Bobbs-Merrill: Fluid Power
IPM-111 Identifying secondary air treatment methods	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Five; Bobbs-Merrill: Fluid Power
IPM-112 Identifying piping, hoses and fittings used in pneumatic systems	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Six; Bobbs-Merrill: Fluid Power
IPM-113 Identifying control valves	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Seven; Bobbs-Merrill: Fluid Power
IPM-114 Identifying pressure relief valves	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Eight; Bobbs-Merrill: Fluid Power

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-115 Identifying cylinders	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Nine
IPM-116 Identifying motors	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Basic Pneumatics, Lesson Ten; Bobbs-Merrill: Fluid Power
IPM-117 Identifying components of pneumatic systems	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson One
IPM-118 Reading pneumatic		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Two
IPM-119 Installing system components	Bobbs-Merrill: "Fluid Power," (TR)	Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Three
IPM-120 Identifying procedures for pneumatic system maintenance		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Four
IPM-121 Determining system failures		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Five
IPM-122 Troubleshooting air compressors		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Six

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
IPM-123 Troubleshooting control valves		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Seven
IPM-124 Troubleshooting cylinders		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Eight
IPM-125 Troubleshooting air motors		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatics Troubleshooting, Lesson Nine
IPM-126 Troubleshooting pneumatic and hydraulic systems		Pease: Basic Fluid Power; Stewart and Storer: Fluid Power	Plant Engineering Training Systems: Pneumatic Troubleshooting, Lesson Ten

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-01 Identifying basic electrical theory	Georgia: "Understanding Basic Electrical Theory," (ST)	AAVIM: Electrical Wiring, Understanding Electricity and Electrical Terms; Alerich: Electrical Construction Wiring	Georgia: Industrial Electricity, Residential Wiring, Units RW-1a, RW-7a; Electricity: Post Secondary, Unit EL-01; Construction Cluster, Basic Electrical Theory, Units BET-1 - BET-10
EL-02 Determining transformer polarity	Bergwall: "Basic Electricity and Electronics Explained - Alternating Current," (FS/T)	Duff: Alternating Current Fundamentals; Westinghouse Maintenance Hints	
EL-03 Connecting to and operating dual voltage single phase transformers	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Part One," (FS/T)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-04 Connecting single phase transformers in series	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Part One," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-05 Connecting single phase transformers in parallel	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Parts One and Two," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-06 Determining the KVA rating of single phase transformers	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Parts One and Two," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers; Manufacturer's catalog	
EL-07 Determining the KVA rating of three phase transformers	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Parts One and Two," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers; Manufacturer's catalog	Standard Electric Time Bulletin
EL-08 Hooking up and operating a one phase auto transformer	Long Filmslide Service: "Transformers," (FS)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-09 Hooking up a one phase buck booster transformer	Long Filmslide Service: "Transformers," (FS)	Croft, Carr and Watt: American Electrician Handbook; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-10 Hooking up a three phase transformer	Long Filmslide Service: "transformers," (FS)	Croft, Carr and Watt: American Electrician Handbook; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
EL-11	Hooking up a three phase auto transformer	Long Filmslide Service: "Transformers," (FS)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-12	Hooking up a three phase transformer bank connected Wye/Wye	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-13	Hooking up a three phase transformer bank connected Delta/Delta	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-14	Hooking up a three phase bank of transformers open Delta	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-15	Hooking up a three phase transformer bank connected Wye/Delta	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin
EL-16	Hooking up a three phase transformer bank connected Delta/Wye	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers	Standard Electric Time Bulletin

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
EL-17	Hooking up a three phase transformer bank; reversed voltage	Long Filmslide Service: "Transformers," (FS)	Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers; Penden and Del-Mar: Electrical Engineer's Handbook	Standard Electric Time Bulletin
EL-18	Hooking up transformers for special applications	Long Filmslide Service: "Transformers," (FS)	Croft, Carr and Watt: American Electrician Handbook; Duff: Alternating Current Fundamentals; Dunlap, Siefert and Austin: Transformers; Penden and Del-Mar: Electrical Engineer's Handbook	Standard Electric Time Bulletin
EL-19	Calculating service load for a small commercial building	Bergwall: "Planning and Roughing In," (FS/T)	Building specifications; Croft, Carr and Watt: American Electrician Handbook; Heine, Dunlap and Jones: Electrical Blueprints; Ramsey and Sleeper: Architectural Graphic Standard; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-1
EL-20	Locating service entrance equipment and writing specifications	Singer Career Systems: "Electric Wire and Cable," (FS/T); "Electrical Boxes," (FS/T); AAVIM: "Electrical Wiring Residential - Utility Buildings - Service Areas," (ST)	Graham: Industrial and Commercial Wiring; Ramsey and Sleeper: Architectural Graphic Standard; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-2

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-21 Selecting a service entrance conductor	AAVIM: "Electrical Wiring Residential - Utility Buildings - Service Areas," (ST)	Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Units CW-3, CW-3a
EL-22 Calculating service conduits	Singer Career Systems: "Electrical Service Entrance," (FS/T); AAVIM: "Electrical Wiring Residential - Utility Buildings - Service Areas," (ST)	Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-3
EL-23 Installing service conduits	AAVIM: "Electrical Wiring Residential - Utility Buildings - Service Areas," (ST)	Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-3
EL-24 Installing service entrance conductors	Singer Career Systems: "Electrical Service Entrance," (FS/T); AAVIM: "Electrical Wiring Residential - Utility Building - Service Areas," (ST)	Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-3a
EL-25 Selecting and installing meters	Singer Career Systems: "Reading Electric Meters," (FS/T)	Equipment catalog; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-4
EL-26 Selecting and installing panels		Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-4

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-27 Calculating and installing motor branch circuits		Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Rosenberg: Electric Motor Repair; Summers: National Electrical Code; Veinott: Horsepower Electric Motors	Square D Manual
EL-28 Installing and operating subfeeders and panels		Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	
EL-29 Grouping outlets onto branch circuits	Singer Career Systems: "Installing Electrical Boxes and Conduit," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-5
EL-30 Installing specific purpose outlets	Bergwall: "Finishing the Installation," (FS/T)	Summers: National Electrical Code	
EL-31 Calculating branch circuit conductors and overcurrent protection	Singer Career Systems: "Circuit Breakers," (FS/T)	Carr, Croft and Watt: American Electrician Handbook; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-5
EL-32 Installing branch circuits and controls for lighting	Bergwall: "Planning and Roughing In," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-33 Selecting conduit		Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-6
EL-34 Installing conduit under a concrete slab		Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	Georgia: Industrial Electricity, Commercial Wiring, Unit CW-7
EL-35 Installing outlet, junction and conduitlets		Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	
EL-36 Installing branch circuits and controls for air conditioning and heating	Bergwall: "Basic AC Electricity for Heat, Ventilation and Air Conditioning - Part One," (FS/T)	Althouse, Turnquist and Bracciano: Modern Refrigeration and Air Conditioning; Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	
EL-37 Selecting and installing branch circuits for three phase water heaters	Bergwall: "Finishing the Installation," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Manufacturer's catalog; Summers: National Electrical Code	

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
EL-43	Selecting and installing a three phase, four wire 480v panel	Hobar: "Electrical Connections and Current Control," (FS)	Adams: Electrical Principles and Practices; Croft, Carr and Watt: American Electrician Handbook; Hubert: Operational Electricity; Summers: National Electrical Code	
EL-44	Selecting the correct transformer bank		Manufacturer's catalog; Summers: National Electrical Code	
EL-45	Selecting and installing a 480v/208-120 three phase four wire service		Croft, Carr and Watt: American Electrician Handbook; Supply catalogs	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-6
EL-46	Installing metering equipment		Croft, Carr and Watt: American Electrician Handbook; Hubert: Operational Electricity; Local codes; Summers: National Electrical Code	Georgia: Industrial Electricity, Industrial Wiring, Units IW-6, IW-7
EL-47	Selecting and installing panels and selecting distribution equipment		Adams: Electrical Principles and Practices; Hubert: Operational Electricity; Manufacturer's catalogs; Summers: National Electrical Code	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-12

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
EL-38	Planning and performing site work for a small industrial facility	Bergwall: "Planning and Roughing In," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	
EL-39	Making calculations for electric motors, welders and heaters	Hobar: "Electric Motors: Enclosures, Bearings and Mounting Methods," (ST)	Summers: National Electrical Code	
EL-40	Calculating the 120 and 277 volt lighting load	Hobar: "Wiring a Switch and Lamp," (ST)	Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Manufacturer's catalog; Summers: National Electrical Code	
EL-41	Calculating and selecting receptacles for 120/208 volt loads		Graham: Industrial and Commercial Wiring; Summers: National Electrical Code	
EL-42	Calculating size for and selecting and installing a Bass-Duct		Croft, Carr and Watt: American Electrician Handbook; Graham: Industrial and Commercial Wiring; Manufacturer's catalog; Summers: National Electrical Code	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-48 Selecting and installing a 277v fluorescent light	Bergwall: "Finishing the Installation," (FS/T); "Low Voltage and Special Circuits," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Fixture catalog; Graham: Industrial and Commercial Wiring	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-13
EL-49 Determining sizes and types of feeders and overcurrent protection devices	Hobar Publications: "Electrical Connections and Current Control," (ST)	Croft, Carr and Watt: American Electrician Handbook; Summers: National Electrical Code	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-16
EL-50 Installing a branch circuit for welders		Croft, Carr and Watt: American Electrician Handbook; Summers: National Electrical Code; Van Vaulkenburgh: Basic Industrial Electricity	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-19
EL-51 Operating a split phase motor	AAVIM: "How Electric Motors Start and Run," (ST)	Croft, Carr and Watt: American Electrician's Handbook; Rosenberg: Electric Motor Repair; Veinott: Fractional and Subfractional Horsepower Electric Motors	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-20
EL-52 Operating a capacitor start motor	AAVIM: "How Electric Motors Start and Run," (ST)	Croft, Carr and Watt: American Electrician Handbook; Rosenberg: Electric Motor Repair; Veinott: Fractional and Subfractional Electric Motors	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-22

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-53 Operating a universal motor	AAVIM: "How Electric Motors Start and Run," (ST)	Adams: Electrical Principles and Practices; Rosenberg: Electric Motor Repair; Veinott: Fractional and Subfractional Horsepower Electric Motors	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-25
EL-54 Operating a three phase induction motor	AAVIM: "How Electric Motors Start and Run," (ST)	Adams: Electrical Principles and Practices; Rosenberg: Electric Motor Repair; Veinott: Fractional and Subfractional Horsepower Electric Motors	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-27
EL-55 Operating a three phase synchronous motor	AAVIM: "How Electric Motors Start and Run," (ST)	Adams: Electrical Principles and Practices; Croft, Carr and Watt: American Electrician Handbook	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-29
EL-56 Operating a three phase, one winding, two speed motor	AAVIM: "How Electric Motors Start and Run," (ST)	Hubert: Operational Electricity; Rosenberg: Electric Motor Repair; Siskind: Electrical Circuits; Electrical Control Systems in Industry	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-30
EL-57 Operating a three phase, two winding, two speed motor	AAVIM: "How Electric Motors Start and Run," (ST)	Hubert: Operational Electricity; Rosenberg: Electric Motor Repair; Siskind: Electrical Circuits; Electrical Control Systems in Industry	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-31

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-58 Operating single and three phase alternators		Adams: Electrical Principles and Practices; Duff: Alternating Current Fundamentals; Siskind: Electrical Circuits; Electrical Control Systems in Industry; Timble and Willson: Industrial Electricity	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Units IW-32 - IW-39
EL-59 Operating an induction regulator		Penden and Del-Mar: Electrical Engineer's Handbook; Siskind: Electrical Circuits; Electrical Control Systems in Industry; Van Volkenburgh, Nooger and Neville: Basic Industrial Electricity	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Unit IW-41
EL-60 Operating a rotary frequency changer		Croft, Carr and Watt: American Electrician Handbook; Siskind: Electrical Circuits; Electrical Control Systems in Industry	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Unit IW-42
EL-61 Operating a synchronous rotary converter		Croft, Carr and Watt: American Electrician Handbook; Timble and Willson: Industrial Electricity	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Unit IW-43
EL-62 Operating a rotary converter	Bergwall: "Rotary Machinery Explained - Direct Current Motors," (FS/T)	Penden and Del-Mar: Electrical Engineer's Handbook; Siskind: Electrical Circuits; Electrical Control Systems in Industry	Standard Electric Time Bulletin; Georgia: Industrical Electricity, Industrial Wiring, Unit IW-44

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-63 Operating DC motors	Bergwall: "Rotary Machinery Explained - Direct Current Motors," (FS/T)	Croft, Carr and Watt: American Electrician Handbook, Duff: Alternating Current Fundamentals; Rosenberg: Electric Motor Repair; Timbel and Willson: Industrial Electricity	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Units IW-45, IW-46, IW-47
EL-64 Operating and checking load characteristics of DC generators		Adams: Electrical Principles and Practices; Duff: Alternating Current Fundamentals	Standard Electric Time Bulletin; Georgia: Industrial Electricity, Industrial Wiring, Units IW-48, IW-49, IW-50
EL-65 Correcting power factors		Adams: Electrical Principles and Practices; Croft, Carr and Watt: American Electrician Handbook	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-51
EL-66 Hooking up and operating gear motors		Croft, Carr and Watt: American Electrician Handbook	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-52
EL-67 Selecting correct machine drive		AAVIM: Electric Motor Drives; Croft, Carr and Watt: American Electrician Handbook	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-53
EL-68 Installing ventilator fans		AAVIM: Electric Motors; Althouse, Turnquist and Bracciano: Modern Refrigeration and Air Conditioning	Georgia: Industrial Electricity, Industrial Wiring, Units IW-54, IW-56

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
EL-69 Identifying motor leads		Rosenberg: Electric Motor Repair; Veinott: Fractional and Subfractional Horsepower Electric Motors	Georgia: Industrial Electricity, Industrial Wiring, Units IW-57, IW-58, IW-59, IW-60
EL-70 Identifying hazardous wiring locations	Career Aids, Inc.: "Electrical Safety in the Shop," (FS/T)	Croft, Carr and Watt: American Electrician Handbook; Summers: National Electrical Code	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-61
EL-71 Operating a power actuated tool		Manufacturer's operator's manual; Summers: National Electrical Code	Georgia: Industrial Electricity, Industrial Wiring, Unit IW-62

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-01 Layout metal surfaces	Bergwall: "Bench Metal Work," (FS); Prentice-Hall: "Machine Shop: Bench Operations," (FS)	Burghardt: Machine Tool Operation (Part I); Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Benchwork Assignment Sheet #1
MS-02 Identifying jig buttons		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Benchwork Assignment Sheet #1
MS-03 Using the sine bar	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #3; Machine Shop Training Course, Vol. 1
MS-04 Using the bevel	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Bench Work Assignment Sheet #4
MS-05 Using steel rules	Bergwall: "Bench Metal Work," (FS); Prentice-Hall: "Machine Shop: Bench Operations," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #5
MS-06 Using the micrometer	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment
MS-07 Reading a vernier	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #7

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-08 Using dial indicators, center testers and speed indicators	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #7
MS-09 Using precision gage blocks, tapered ring, plug and snap gages	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #9; Machine Shop Training Course, Vol. I
MS-10 Identifying and using hand hacksaws	Bergwall: "Bench Metal Work," (FS); Prentice-Hall: "Machine Shop: Bench Operations," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #10
MS-11 Using abrasives and lapping compounds	Bergwall: "The Lathe Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #11
MS-12 Identifying and using files	Bergwall: "Bench Metal Work," (FS); Prentice-Hall: "Machine Shop: Bench Operations," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #12

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-13 Scraping flat and curved bearings	Bergwall: "Bench Metal Work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #13
MS-14 Using hammers and screwdrivers for hand bench use	Bergwall: "Bench Metal Work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #14
MS-15 Identifying and using wrenches	Bergwall: "Bench Metal Work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #15
MS-16 Using bench vises and clamps		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #16
MS-17 Identifying and using chipping tools		Burghardt: Machine Tool Operation (Part I); Kibbe Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #17; Machine Shop Training Course, Vol. 2

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-18 Using hand taps, dies and hand reamers	Bergwall: "Bench Metal Work," (FS); Prentice-Hall: "Machine Shop: Bench Operations," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #18
MS-19 Identifying power tool safety practices	Bergwall: "Working With Power Tools and Machines," (FS)	Dover: Tools and Their Uses	Ohio: Machine Trades I, Bench Work Assignment Sheet #19
MS-20 Assembling and pitting	Bergwall: "Bench Metal Work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #20; Machine Shop Training Course, Vol. I
MS-21 Identifying fasteners	Prentice-Hall: "Working with Nuts and Bolts," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #21; Machine Shop Training Course, Vol. I
MS-22 Using thread, center, fillet and radius	Bergwall: "Measuring Tools Explained," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #22; Machine Shop Training Course, Vol. I
MS-23 Identifying lubricants and greases	Bergwall: "The Lathe Explained," (FS)	Machinery's Handbook	Ohio: Machine Trades I, Bench Work Assignment Sheet #23
MS-24 Performing machine maintenance	Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Specific manufacturer's service manuals	Ohio: Machine Trades I, Bench Work Assignment Sheet #24

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
MS-25	Identifying bench work safety	Bergwall: "Metal Shop Safety," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Bench Work Assignment Sheet #25
MS-26	Identifying parts and functions of the drilling machine	Prentice-Hall: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #1
MS-27	Identifying safety practices and precautions when using the drilling machine	Prentice-Hall: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #2
MS-28	Identifying work-holding devices and set ups	Prentice-Hall: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #3
MS-29	Identifying and using drill bit holding devices	Prentice-Hall: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #4

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-30 Identifying drill bits		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #5
MS-31 Identifying cutting feeds and speeds		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices, Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #6
MS-32 Identifying principles of straight drilling	Bergwall: "Bench Metalwork," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #7
MS-33 Identifying and using coolants and cutting compounds	Bergwall: "Bench Metalwork," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #8
MS-34 Grinding and care of drills	Bergwall: "Bench Metalwork," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #9

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-35 Identifying and using twist drill gages	Bergwall: "Bench Metal-work," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Maching Work Assignment Sheet #10
MS-36 Identifying and using drill grinding machines	Bergwall: "Bench Metal-work," (FS); Prentice-Hall Media: "Maching Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #11
MS-37 Identifying machine reamers	Bergwall: "Bench Metal-work," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #6
MS-38 Machine reaming	Bergwall: "Bench Metal-work," (FS); Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #13
MS-39 Identifying principles of boring and counterboring	Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #14

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-40 Spot facing	Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #15
MS-41 Counter sinking and center drilling	Prentice-Hall Media: "Machine Shop: Drill Press," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Drilling Machine Work Assignment Sheet #16
MS-42 Identifying lathe safety	Bergwall: "Metal Shop Safety," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #1
MS-43 Identifying lathes	Bergwall: "The Lathe Explained," (FS) Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #2
MS-44 Identifying work-holding devices	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #3

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-45 Identifying cutting tools	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #3
MS-46 Identifying Measuring tools	Bergwall: "Measuring Tools," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #6; Machine Shop Training Course, Vol. I
MS-47 Identifying lathe attachments	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #7
MS-48 Calculating cutting feeds and speeds on the lathe	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment #8; Machine Shop Training Course, Vol. I
MS-49 Determining RPM	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #9; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-50 Centering stock	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #10; Machine Shop Training Course, Vol. I
MS-51 Identifying principles of facing	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #11; Machine Shop Training Course, Vol. I
MS-52 Identifying principles of straight turning	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #12; Machine Shop Training Course, Vol. I
MS-53 Identifying chucks	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #13; Machine Shop Training Course, Vol. I
MS-54 Form turning	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #14; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-55 Identifying face plate work	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #16; Machine Shop Training Course, Vol. I
MS-56 Using draw-in collets	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #17; Machine Shop Training Course, Vol. I
MS-57 Identifying principles of drilling	Bergwall: "Bench Metal-work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #18; Machine Shop Training Course, Vol. I
MS-58 Identifying machine reamers	Bergwall: "Bench Metal-work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #19; Machine Shop Training Course, Vol. I
MS-59 Reaming on the engine lathe	Bergwall: "Bench Metal-work," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #20; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-60 Boring on the engine lathe	Bergwall: "Bench Metalwork," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #21; Machine Shop Training Course, Vol. I
MS-61 Identifying and using mandrels	Bergwall: "Bench Metalwork," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #22; Machine Shop Training Course, Vol. I
MS-62 Knurling on the engine lathe	Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #23; Machine Shop Training Course, Vol. I
MS-63 Cutting off on the engine lathe	Bergwall: "Bench Metalwork," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #24; Machine Shop Training Course, Vol. I
MS-64 Identifying thread cutting devices	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #25; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-65 Identifying the parts of a thread		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #26; Machine Shop Training Course, Vol. I
MS-66 Identifying American National thread standards		Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #27; Machine Shop Training Course, Vol. I
MS-67 Computing American National thread form		Burghardt: Machine Tool Operation (Part I)	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #28; Machine Shop Training Course, Vol. I
MS-68 Computing sharp V-thread formulas		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #29; Machine Shop Training Course, Vol. I
MS-69 Identifying acme threads		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #30; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-70 Using the acme tap	Bergwall: "Bench Metalwork," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #31
MS-71 Identifying square threads		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #32; Machine Shop Training Course, Vol. I
MS-72 Identifying classes		Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #33
MS-73 Using thread gauges	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #34
MS-74 Using a thread micrometer	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #35; Machine Shop Training Course, Vol. I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-75 Measuring threads with the three-wire method	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #36; Machine Shop Training Course, Vol. I
MS-76 Cutting threads with an even geared lathe	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #37; Machine Shop Training Course, Vol. I; Georgia, Metals Fabrication Mathematics
MS-77 Cutting threads on a lathe which is not even geared	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #38 Georgia, Metals Fabrication Mathematics
MS-78 Cutting threads on a quick-change gear lathe	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #40; Machine Shop Training Course, Vol. I
MS-79 Identifying multiple lead screw threads	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #41

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
MS-80	Cutting left hand threads	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #42
MS-81	Determining a tap drill size	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #43; Machine Shop Training Course, Vol. II
MS-82	Cutting internal threads and tapping	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #44
MS-83	Identifying principles of taper turning	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #45 Machine Shop Training Course, Vol. I
MS-84	Computing tapers	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #46; Machine Shop Training Course, Vol. I

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
MS-85	Measuring short tapers	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #47; Machine Shop Training Course, Vol. I
MS-86	Gaging inside and outside tapers	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #48
MS-87	Tapering by the off-set tailstock method	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices: Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #49 Machine Shop Training Course, Vol. I
MS-88	Cutting a taper with the compound rest	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #50, Machine Shop Training Course, Vol. I
MS-89	Cutting a taper with the taper attachment	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assighment Sheet #51

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
MS-90 Boring or turning internal tapers	Bergwall: "The Lathe Explained," (FS); Prentice-Hall Media: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #54
MS-91 Identifying coolants and cutting components	Prentice-Hall Media: Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices; Porter: Machine Shop Operations and Setups	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #53; Machine Shop Training Course, Vol. I
MS-92 Identifying lubricants	Bergwall: "Machine Shop: Engine Lathe," (FS)	Burghardt: Machine Tool Operation (Part I); Kibbe: Machine Tool Practices	Ohio: Machine Trades I, Engine Lathe Work Assignment Sheet #54

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
WLD-01 Identifying and using welding symbols		Griffin: Welding Processes; Schell and Matlock: Industrial Welding Procedures	
WLD-02 Using welding related shop tools		Griffin: Welding Processes; Schell and Matlock: Industrial Welding Procedures	
WLD-03 Identifying and preparing metals for welding	Georgia: "Metallurgy," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Welding Processes; Oregon: Welding	
WLD-04 Measuring welding materials		Georgia: Welding, Instructor Guide; Oregon: Welding	Georgia: Welding, Phase A, Unit 7-A
WLD-05 Using clamps and jigs		Griffin: Basic TIG & MIG	
WLD-06 Reading blueprints			

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
OXA-01	Following safety procedures and regulations for oxyacetylene welding	Georgia: Welding, "Safety," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding	Georgia: Welding, Phase A, Unit 5
OXA-02	Using oxyacetylene cylinders and gases	Georgia: Welding, "Cylinders and Gases," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 2
OXA-03	Inspecting oxygen and acetylene regulators	Georgia: Welding, "Regulators," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 3
OXA-04	Selecting and maintaining oxyacetylene torches and tips	Georgia: Welding, "Torches and Tips," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 4

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
OXA-05 Setting up and lighting the oxyacetylene torch	Georgia: Welding, "Setting Up and Lighting the Torch," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 6
OXA-06 Carrying a puddle without a filler rod	Georgia: Welding, "Carrying a Puddle Without a Rod," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 8
OXA-07 Welding an outside corner joint without a filler rod	Georgia: Welding, "Welding an Outside Corner Joint," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 9
OXA-08 Making beads with filler rods		Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 10

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
OXA-09 Welding butt joints	Georgia: Welding, "Welding in a Flat Position," (ST); "Vertical and Overhead Welding," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Units A-11 and A-12
OXA-10 Welding lap joints		Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit 12
OXA-11 Welding T-joints	Georgia: Welding, "Welding T-Joints," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia, Welding, Phase A, Unit A-13
OXA-12 Setting up the oxyacetylene apparatus for flame cutting	Georgia: Welding, "The Flame Cutting Process," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia, Welding, Phase A, Unit A-14

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
OXA-13	Cutting with an oxyacetylene cutting torch	Georgia: Welding, "Cutting a Straight Line," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit A-15
OXA-14	Piercing and cutting holes	Georgia: Welding, "Cutting and Piercing Holes," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit A-16
OXA-15	Cutting with an automatic oxyacetylene cutting machine	Georgia: "Setting Up the Automatic Cutting Machine," (ST)	Georgia: Welding, Instructor Guide; Althouse: Modern Welding; Cutting machine manual; Oregon: Welding	Georgia: Welding, Phase A, Unit A-17
OXA-16	Welding beads with brass rods	Georgia: "Running Beads with a Brass Rod," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit A-18

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
OXA-17	Brazing a lap joint using oxyacetylene apparatus		Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Oxyacetylene; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit A-19
OXA-18	Brazing with silver		Oregon: Welding	
OXA-19	Soldering copper, sheet metal and other metals	Georgia: "Silver Soldering Process," (ST)	Georgia: Welding, Instructor Guide; Althouse: Modern Welding; Oregon: Welding	Georgia, Welding, Phase A, Unit A-20
OXA-20	Welding cast iron	Georgia: "Welding in Cast Iron," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding	Georgia: Welding, Phase A, Unit A-21
OXA-21	Cutting and welding pipe	Georgia: "Pipe Welding," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase A, Unit A-22

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
ARC-01	Selecting and setting up shielded arc welding apparatus	Georgia: "Introduction to Shielded Arc Welding," (ST); "Shielded Arc Welding," (ST); "Identification of Arc Welding Machines," (ST); "Electrical Circuits," (ST); "Setting Up Welding Machine and Striking an Arc," (ST); "Identifying and Selecting Electrodes," ((ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding	Georgia: Welding, Phase B Units B-1, B-2, B-3, B-4A, B-5, B-6 and B-9
ARC-02	Welding string and weaving beads	Georgia: "Weld String and Weave Beads in the Overhead Position," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Oregon: Welding; Griffin: Basic Arc Welding	Georgia: Welding, Phase B, Units B-23, B-24, B-34 and B-37
ARC-03	Arc welding string beads and padding a plate	Georgia: "Welding a Part of Beads in the Flat Position," (ST); "Padding a Plate of Beads in the Horizontal Position," (ST); "Padding a Plate in the Vertical Position," (ST)	Georgia: Welding, Instructor Guide; Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Griffin: Basic Arc Welding	Georgia: Welding, Phase B, Units B-7, B-12, B-16 and B-18
ARC-04	Arc welding lap joints	Georgia: "Welding a Lap Joint in the Horizontal Position," (ST)	Georgia: Welding, Instructor; Althouse: Modern Welding; Oregon: Welding; Schell and Matlock: Industrial Welding Procedures; Griffin: Basic Arc Welding	Georgia: Welding, Phase B, Units B-10, B-14, B-20, B-25, B-36 and B-39

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
ARC-05 Arc welding butt joints	Georgia: "Welding Butt Joints in the Flat Position," (ST)	Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Schell and Matlock: Industrial Welding Procedures; Georgia: Welding, Instructor Guide; Griffin: Basic Arc Welding	Georgia: Welding, Phase B, Units B-8, B-13, B-17, B-19, B-24, B-27, B-30, B-32, B-35 and B-38
ARC-06 Shield arc welding T-fillet joints		Giachino and Weeks: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Schell and Matlock: Industrial Welding Procedures; Georgia: Welding, Instructor Guide; Griffin: Basic Arc Welding	Georgia: Welding, Phase B, Units B-11, B-15, B-21, B-22, B-26, B-31 and B-33
ARC-07 Testing arc welded joints		Giachino and Weeks: Welding Skills and Practices; Griffin: Basic Arc Welding; Oregon: Welding; Georgia: Welding, Instructor Guide	

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AC-01	Identifying major components and functions of air conditioning systems	Georgia: "Demonstrate a Knowledge of Air Conditioning Systems," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-01
AC-02	Applying basic air principles	Georgia: "Applying Basic Air Principles," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Carrier Corp.: Carrier Manual	Georgia: Air Conditioning, Unit AC-02
AC-03	Calculating heat loads	Georgia: "Calculating Heat Loads," (ST)	Delmar: Principles of Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-03
AC-04	Applying principles of air movement	Georgia: "Applying Principles of Air Movement," (ST)	Delmar: Principles of Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-04
AC-05	Servicing air filtering systems	Georgia: "Identifying Air Filtering Systems," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-05

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AC-06 Installing condensate drains	Georgia: "Installing Condensate Drain," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-13
AC-07 Installing residential and mobile home package air conditioning units	Georgia: "Installing Package Unit (Residential and Mobile Home)," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Air Conditioning, Unit AC-14
AC-08 Installing split system air conditioning units	Georgia: "Installing Split Systems," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-15
AC-09 Installing add-on split air conditioning systems	Georgia: "Installing Add-on Split Systems," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-16

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AC-10	Troubleshooting compressor burnout	Georgia: "Troubleshooting Compressor Burnout," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-17
AC-11	Troubleshooting fans and fan motors	Georgia: "Troubleshooting Fans and Fan Motors," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-18
AC-12	Performing pre-season start-up and air conditioner service	Georgia: "Performing Pre-Season Start-Up," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-19
AC-13	Troubleshooting air conditioner refrigeration cycle	Georgia: "Troubleshooting Air Conditioners (Refrigeration Cycle)," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-20

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AC-14 Troubleshooting air conditioner electrical cycle		Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia: Air Conditioning, Unit AC-21
AC-15 Troubleshooting air conditioner air movement	Georgia: "Troubleshooting Air Conditioners (Air Movement)," (ST)	Delmar: Principles of Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Prentice-Hall: Refrigeration and Air Conditioning; Doolin: Doolin's Troubleshooter's Bible	Georgia, Air Conditioning, Unit AC-22
AC-16 Applying principles of the heat pump	Georgia: "Understanding Principles of the Heat Pump," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-23
AC-17 Evacuating and charging a heat pump		Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-24

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
AC-18	Installing a reversing valve		Prentice-Hall: Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-25
AC-19	Tracing the heat pump refrigeration cycle	Georgia: "Refrigeration Cycle and Components," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-26
AC-20	Installing electrical circuits	Georgia: "Inspecting Electrical Circuits," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-27
AC-21	Adjusting and repairing defrost controls	Georgia: "Adjusting and Repairing Defrost Controls," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Air Conditioning and Refrigeration; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-28
AC-22	Installing package heat pumps	Georgia: "Installing Package Heat Pumps," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Air Conditioning and Refrigeration; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-29

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
AC-23 Installing split-system heat pumps	Georgia: "Installing Split-System Heat Pumps," (ST)	Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Delmar: Principles of Air Conditioning	Georgia: Heat Pumps, Unit AC-30

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
HE-01 Applying principles of electric furnaces and controls	Georgia: "Applying Principles of Electric Furnaces and Controls," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Cooper: Warm Air Heating for Climate Control; Manufacturer's instruction and operation manual	Georgia: Heating, Unit HE-01
HE-02 Installing electric furnaces		Prentice-Hall: Refrigeration and Air Conditioning; Althouse: Modern Refrigeration and Air Conditioning; Cooper: Warm Air Heating for Climate Control; Manufacturer's installation instructions	Georgia: Heating, Unit HE-02
HE-03 Troubleshooting electric furnaces	Georgia: "Troubleshooting Electric Furnaces," (ST)	Cooper: Warm Air Heating for Climate Control; Manufacturer's instructions for electric furnaces	Georgia: Heating, Unit HE-03
HE-04 Applying gas fuel combustion and safety principles	Georgia: "Applying Gas Fuel Combustion and Safety Principles," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Carrier: Gas Piping and Combustion; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-04
HE-05 Identifying major components and functions of gas heating systems	Georgia: "Understanding Basic Gas Systems," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-05

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
HE-06 Checking gas sources	Georgia: "Checking Gas Sources," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Carrier Heating Manual	Georgia: Heating, Unit HE-06
HE-07 Applying gas piping principles	Georgia: "Gas Piping Principles," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-07
HE-08 Installing and adjusting gas regulators	Georgia: "Adjusting Regulators," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-08
HE-09 Installing and servicing gas valves	Georgia: "Installing and Servicing Gas Valves," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-09
HE-10 Installing and servicing pilot ignition devices	Georgia: "Installing and Servicing Pilot Ignition Devices," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-10
HE-11 Installing and servicing combination gas valves	Georgia: "Installing and Servicing Combination Gas Valves," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-11
HE-12 Servicing gas burners	Georgia: "Servicing Gas Burners," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-12
HE-13 Inspecting and adjusting temperature rise of heat exchangers	Georgia: "Inspecting and Determining Temperature Rise of Heat Exchangers," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-13

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
HE-14 Venting gas heating systems		Carrier Heating Manual; Prentice-Hall: Refrigeration and Air Conditioning	Georgia: Heating, Unit HE-14
HE-15 Servicing gas furnace electrical controls	Georgia: "Servicing Electrical Controls," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-15
HE-16 Determining combustion efficiency	Georgia: "Determining Combustion Efficiency," (ST)	Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-16
HE-17 Performing a pre-season check-up and start-up on a gas furnace	Georgia: "Performing Pre-Season Check-Up and Start-Up," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Cooper: Warm Air Heating for Climate Control; Manufacturer's instruction and maintenance manual	Georgia: Heating, Unit HE-17
HE-18 Troubleshooting the gas heating system		Carrier Heating Manual; Cooper: Warm Air Heating for Climate Control	Georgia: Heating, Unit HE-18
HE-19 Identifying types of fuel oil and their principles of combustion		Burghardt: Domestic and Commercial Oil Burners; Carrier: Oil Burners	Georgia: Heating, Unit HE-19
HE-20 Designing and installing oil piping		Burghardt: Domestic and Commercial Oil Burners; Georgia State Code	Georgia: Heating, Unit HE-20
HE-21 Installing oil burners	Georgia: "Installing Oil Burners," (ST)	Burghardt: Domestic and Commercial Oil Burners	Georgia: Heating, Unit HE-21

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
HE-22	Installing and servicing transformers and electrodes	Georgia: "Installing and Servicing Transformers and Electrodes," (ST)	Burghardt: Domestic and Commercial Oil Burners; Field: Oil Burners	Georgia: Heating, Unit HE-22
HE-23	Installing oil pumps	Georgia: "Installing Oil Pumps," (ST)	Althouse: Modern Refrigeration and Air Conditioning; Burghardt: Domestic and Commercial Oil Burners	Georgia: Heating, Unit HE-23
HE-24	Servicing blower, nozzle, motor and and coupling		Burghardt: Domestic and Commercial Oil Burners; Cooper: Warm Air Heating for Climate Control; Field: Oil Burners	Georgia: Heating, Unit HE-24
HE-25	Performing the combustion efficiency test	Georgia: "Installing Vent and Heat Exchanger," (ST)	Burghardt: Domestic and Commercial Oil Burners; Georgia State Code	Georgia: Heating, Unit HE-25
HE-26	Installing controls		Burghardt: Domestic and Commercial Oil Burners	Georgia: Heating, Unit HE-26
HE-27	Performing pre-season start-up and check-up on an oil burning heating system	Georgia: "Performing Pre-Season Start-Up and Check-Ups," (ST)	Burghardt: Domestic and Commercial Oil Burners; Cooper: Warm Air Heating for Climate Control; Manufacturer's operation and maintenance manuals	Georgia: Heating, Unit HE-27
HE-28	Troubleshooting the oil burning heating system	Georgia: "Troubleshooting the Oil Burning Heat System," (ST)	Burghardt: Domestic and Commercial Oil Burners; Cooper: Warm Air Heating for Climate Control; Manufacturer's manuals	Georgia: Heating, Unit HE-28

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
SM-01	Identifying materials used in sheet metalwork	Bergwall: "Sheet Metalwork, Introduction and Overview," (FS)	Johnson: Technical Metals; Feirer: Metalwork	
SM-02	Developing sheet metal patterns	Bergwall: "Straight Line Pattern Development," (FS); "Parallel and Radial Line Development," (FS)	Johnson: Technical Metals; Ferier: Metalwork	
SM-03	Cutting sheet metal	Prentice-Hall: "Cutting Sheet Metal," (FS); Bergwall: "Cutting Methods," (FS)	Johnson: Technical Metals; Feirer: Metalwork	
SM-04	Bending sheet metal by hand	Bergwall: "Drilling, Forming and Bending-Part 2," (FS)	Johnson: Technical Metals; Feirer: Metalwork	
SM-05	Bending metal on a bar folder or brake	Bergwall: "Drilling, Forming and Bending-Part 1," (FS)	Johnson: Technical Metals; Feirer: Metalwork	
SM-06	Roll-forming		Johnson: Technical Metals; Feirer: Metalwork	
SM-07	Making seams	Prentice-Hall: "Seams and Joints," (FS); Bergwall: "Assembly and Fastening," (FS)	Johnson: Technical Metals; Feirer: Metalwork	
SM-08	Using the rotary machine		Johnson: Technical Metals; Feirer: Metalwork	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
SM-09 Fastening sheet metal	Bergwall: "Assembly and Fastening," (FS); Prentice-Hall: "Riveting and Fastening," (FS); "Making Holes in Sheet Metal," (FS)	Johnson: Technical Metals; Feirer: Metalwork	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-01 Reading and interpreting the shop service manuals			
VM-02 Identifying and maintaining shop tools and equipment	Bergwall: "Automotive Hand Tools Explained," (FS/C); Prentice-Hall: "Auto Mechanics Tools and Basic Skills," (FS/C)	Crouse and Anglin: Automotive Tools, Fasteners and Measurements	MAVCC: Auto Mechanics or Small Engines Program
VM-03 Using precision measurement tools and equipment	Georgia: Metals Fabrication Cluster, "Parts of the Micrometer," (ST); Prentice-Hall: "Machine Shop Bench Operating," (FS)	Stovett: How to Read, Use and Care for Micrometers and Vernier Gages	
VM-04 Demonstrating an understanding of engine theories of operation	Bergwall: "The Internal Combustion Engine Explained," (FS); "The Four-Cycle Diesel Engine Explained," (FS); Prentice-Hall: "The Basic Engine," (FS)	AAVIM: Care and Operation of Small Engines, Vol. 1; Maintenance and Repair of Small Engines, Vol. 2; Briggs and Stratton: Repair Instructions IV; Glenn: Auto Mechanics; Mitchell Manuals: Repair Manual; Pipe: Small Gasoline Engines Training Manual; Stephenson: Power Technology; Stockel: Automechanics Fundamentals	

CURRICULUM AREA: INDUSTRIAL MAINTENANCE

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-05 Demonstrating a knowledge of electricity fundamentals	AAVIM: "Understanding Electricity and Electrical Terms," (SS/TR); Prentice-Hall: "Basic Automotive Service," (FS); "Auto Mechanics Tool and Basic Skills," (FS); Briggs and Stratton: "Custom VOA Meter," (SS); "Glossary of Electrical Terms," (SS); "Electricity and Basic Electrical Terms," (SS)	AAVIM: Understanding Electricity and Electrical Terms	
VM-06 Demonstrating an understanding of fuels	AAVIM: "Selecting and Storing Fuels and Lubricants," (SS/TR)	AAVIM: Selecting and Storing Fuels and Lubricants; Crouse: Automotive Mechanics; Stockel: Auto Mechanics Fundamentals	
VM-07 Demonstrating an understanding of lubricants		AAVIM: Small Engines, Vol. I, II; Crouse: Automotive Mechanics; Stockel: Auto Mechanics Fundamentals	
VM-08 Demonstrating an understanding of hardware and fasteners	Prentice-Hall: "Auto Mechanics Tools and Basic Skills," (FS)		

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
VM-09	Demonstrating basic metals operations	Georgia: Transportation Cluster, "Constructing a Thread Gauge Block," (ST); "Removing Broken Stud and Installing Helicoil," (ST); Prentice-Hall: "Machine Shop: Bench Operations," (FS)		Georgia: Transportation Cluster, Unit HT 3-5
VM-10	Demonstrating welding and soldering techniques	Georgia: Metal Fabrication Cluster, "Setting Up Gas Cutting Equipment," (ST); "Straight Cutting with the Gas Torch," (ST); "Circular Cutting with the Gas Torch," (ST); "Piercing and Hole Cutting with the Gas Torch," (ST); "Making Bevel Cuts with the Gas Cutting Torch," (ST); "Setting Up Gas Welding Equipment," (ST); "Neutral Flames," (ST); "Flange Welding," (ST); "Running Fusion Beads," (ST); "Making Weld Beads Using Filler Rod," (ST); "Making a Square Edge Buttweld," (ST); "Making a Lap Joint," (ST); "Making an Outside Corner Joint with a Rod," (ST)	Althouse, Turnquist and Bowditch, Modern Welding	Georgia: Metals Fabrication Cluster, Units BW-5, GC 1-5 and GW 1-9

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-11 Checking and changing engine oil and oil filter	Georgia: Transportation Cluster, "Chassis Lubrication," (ST); "Change Oil and Oil Filter," (ST); Georgia: Auto Mechanics, "Servicing the Engine Lubrication System," (ST); Bergwall: "Lubrication Services," (FS); Prentice-Hall: "Basic Automotive Service," (FS)	Glenn: Auto Mechanics; Remling: Basics; Toboldt and Johnson: Automotive Encyclopedia	Georgia: Transportation Cluster, Units CL-1, CL-2; Georgia: Auto Mechanics, Unit 212-2; Oklahoma: Auto Mechanics I
VM-12 Checking fluid level and refilling transmission and rear end	Georgia: Transportation Cluster, "Changing Automatic Transmission Fluid," (ST); Bergwall: "Lubrication Services," (FS); Prentice-Hall: "Basic Automotive Service," (FS)	Crouse and Anglin: The Auto Book; Crouse and Anglin: Motor Vehicle Inspection; Remling: Basics	Georgia: Transportation Cluster, Unit CL-5; Oklahoma: Auto Mechanics II
VM-13 Lubricating chassis and components	Georgia: Auto Mechanics, "Lubricate the Chassis," (ST); Bergwall: "Lubrication Services," (FS); Prentice-Hall: "Basic Automotive Service," (FS)	Crouse and Anglin: The Auto Book; Crouse and Anglin: Motor Vehicle Inspection; Remling: Basics; Stockel: Auto Mechanics Fundamentals	Georgia: Transportation Cluster, Unit CL-4; Georgia: Auto Mechanics, Unit 212-3
VM-14 Checking and replacing windshield wiper blades		Crouse and Anglin: The Auto Book	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-15 Repairing tires and tubes	Georgia: Transportation Cluster, "Dismount and Mount a Tire," (ST); Prentice-Hall: "Basic Automotive Service," (FS)	Crouse and Anglin: The Auto Book; Crouse and Anglin: Motor Vehicle Inspection; Toboldt and Johnson: Automotive Encyclopedia	Georgia: Transportation Cluster, Unit SSS-3; Oklahoma: Auto Mechanics I
VM-16 Replacing light bulbs and fuses	Prentice-Hall: "Basic Automotive Service, (FS)	Crouse and Anglin: The Auto Book; Crouse and Anglin: Motor Vehicle Inspection; Remling: Basics; Stockel: Auto Mechanics Fundamentals	Oklahoma: Auto Mechanics II; Ellinger: Automotive Electrical Systems
VM-17 Washing and waxing vehicle			Vehicle owner's manual
VM-18 Adjusting fuel/air mixtures and mechanical linkage	Georgia: Transportation Cluster, "Inspect, Assemble, Adjust a Single Barrell Rochester Carburetor," (ST); Bergwall: "The Operation of the Fuel System," (FS); Ford: "Fuel and Carburetion," (FS)	Crouse and Anglin: Automotive Fuel Lubricating and Cooling Systems; Stockel: Auto Mechanics Fundamentals	Oklahoma: Auto Mechanics I; Georgia: Transportation Cluster, Unit FS-4; Ford: Student Text
VM-19 Cleaning or replacing fuel and air filters	Bergwall: "The Operation of the Fuel System," (FS); Georgia: Auto Mechanics, "Service Air Cleaner," (ST)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Mechanics Fundamentals	Oklahoma: Auto Mechanics I; Georgia; Auto Mechanics, Unit 213-10
VM-20 Removing carburetor from engine	Ford: "Carburetor Two and Four Venturi," (TR)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Mechanics Fundamentals	Oklahoma: Auto Mechanics I

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-21 Disassembling, cleaning and inspecting carburetor	Georgia: Transportation Cluster, "Overhauling a Single Barrell Carburetor," (ST) FS-3B; "Overhauling a Single Barrell Carburetor," (ST) FS-3A; "Overhauling a Two Barrell Rochester Carburetor," (ST); "Overhauling a Two Barrell Carburetor," (ST); "Overhauling a Single Barrell Rochester Carburetor," (ST); "Overhauling a Single Barrell Ford Type Carburetor," (ST); "Overhauling a Two Barrell Rochester Carburetor," (ST); "Overhauling a Chrysler Two Barrell Carburetor," (ST); "Overhauling a Two Barrell Ford Type Carburetor," (ST); Bergwall: "The Operation of the Fuel System," (FS); Prentice-Hall: "Fuel Systems," (FS): Ford: Carburetor Service," (ST)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Mechanics Fundamentals	Georgia: Transportation Cluster, Units FS-3, FS-5; Georgia: Auto Mechanics, Units 213-3 - 213-7
VM-22 Reassembling and testing carburetor	Bergwall: "How to Overhaul a Carburetor," (FS)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Service and Repair	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-23 Testing and replacing fuel pumps	Georgia: Transportation Cluster, "Testing and Replacing the Fuel Pump," (ST); Georgia: Auto Mechanics, "Test and Replace Fuel Pump," (ST); Bergwall: "The Operation of the Fuel System," (FS)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Service and Repair	Georgia: Transportation Cluster, Unit FS-2; Georgia: Auto Mechanics, Unit 213-2; Oklahoma: Auto Mechanics I
VM-24 Servicing fuel tank, lines, hoses and fuel level monitoring devices	Georgia: Transportation Cluster, "Cleaning and Repairing the Fuel System Components," (ST); Georgia: Auto Mechanics, "Clean or Repair Fuel Tank or Lines," (ST); Bergwall: "The Operation of the Fuel System," (FS)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Service and Repair	Georgia: Transportation Cluster, Unit FS-1; Georgia: Auto Mechanics, Unit 213-1; Oklahoma: Auto Mechanics I

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TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audiovisuals	Textbooks	Student Materials
VM-25	Diagnosing fuel system problems	Georgia: Transportation Cluster, "Cleaning and Repairing the Fuel System Components, (ST); "Testing and Replacing the Fuel Pump," (ST); "Overhauling a Single Barrell Carburetor," (ST) FS-3A; "Overhauling a Single Barrell Carburetor," (ST) FS-3B; "Inspect, Assemble, Adjust a Single Barrell Carburetor," (ST); "Overhauling a Two Barrell Rochester Carburetor," (ST); "Overhauling a Two Barrell Carburetor," (ST); Bergwall: "The Operation of the Fuel System," (FS)	Crouse and Anglin: Automotive Fuel, Lubricating and Cooling Systems; Stockel: Auto Service and Repair	Oklahoma: Auto Mechanics I; Ford: Carburetor Diagnosis
VM-26	Inspecting, selecting and installing spark plugs	Bergwall: "The Ignition System," (FS); Prentice-Hall: "Electrical Ignition Service," (FS); Georgia: Transportation Cluster, "Removing Spark Plugs from the Engine," (ST); "Cleaning Spark Plugs," (ST); "Gapping Spark Plugs," (ST); "Testing Spark Plugs," (ST); "Installing Spark Plugs," (ST)	Crouse and Anglin, Automotive Tune-Up; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Transportation Cluster, Units SPS-1 - SPS-5; Georgia: Auto Mechanics, Unit 223-9; Oklahoma: Auto Mechanics II

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-27 Timing the ignition	Georgia: Transportation Cluster, "Installing a Distributor," (ST); Bergwall: "The Ignition System," (FS)	Crouse and Anglin: Automotive Tune-Up; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Transportation Cluster, Unit TID-5; Oklahoma: Auto Mechanics II
VM-28 Inspecting and replacing circuit wiring, distributor cap and rotor	Bergwall: "The Ignition System," (FS); Georgia: Auto Mechanics, "Replace Distributor Cap and Spark Plug Wires," (ST)	Crouse and Anglin: Automotive Tune-Up; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Auto Mechanics, Unit 223-8; Oklahoma: Auto Mechanics II
VM-29 Testing, removing and replacing battery ignition components	Ford: "Ignition Systems," (ST); Georgia: Transportation Cluster, "Testing Ignition Coil and Condenser," (ST) TIC-1; "Testing Ignition Coil and Condenser," (ST) TIC-2; "Installing Points in a Distributor," (ST); Georgia: Auto Mechanics, "Test Ignition Coil and Condenser," (ST); Bergwall: "How To Do Major Engine Tune-Up," (FS); Prentice-Hall: "Electrical Ignition Service," (FS)	Crouse and Anglin: Automotive Tune-Up; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Transportation Cluster, Units TIC-1,2; TID-3; Georgia: Auto Mechanics, Unit 223-10

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-30 Testing, removing and replacing electronic ignition components	Bergwall: "Electronic Ignition Explained," (FS); Ford, "Solid State Ignition Systems," (ST); Prentice-Hall: "Electronic Ignition Service," (FS); Georgia: Auto Mechanics, "Ignition System for 1972," (ST)	Crouse and Anglin: Automotive Tune-Up; Johnson: Automotive Diagnosis and Tune-Up	Ford: Solid State Ignition Systems; Georgia: Auto Mechanics, Unit 262-4; Oklahoma: Auto Mechanics II
VM-31 Using and interpreting the ignition analyzer	Bergwall: "The Ignition System," (FS); Ford: "Ignition System Diagnosis and Adjustment," (TR); Georgia: Auto Mechanics, "Engine Diagnosis with Sun Scope," (ST); Georgia: Transportation Cluster, "Performing Engine Tests," (ST); "Identifying Scope Patterns," (ST); "Testing Firing System with a Scope," (ST); "Running Power Balance Test on Cylinder," (ST)	Crouse and Anglin: Automotive Tune-Up; Johnson: Automotive Diagnosis and Tune-Up; Sun Electric Corp.: Ignition Analyzer Handbook; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Transportation Cluster, Units STE-3-6; Georgia: Auto Mechanics, Units 232-12
VM-32 Diagnosing ignition system problems	Bergwall: "The Ignition System," (FS); Prentice-Hall: "Electrical Ignition Service," (FS); "Electronic Ignition Service," (FS)	Crouse and Anglin: Automotive Tune-Up; Johnson: Automotive Diagnosis and Tune-Up; Sun Electric Corp.: Ignition Analyzer Handbook; Wetzel: Automotive Diagnosis and Tune-Up	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
VM-33 Servicing battery and cables	Prentice-Hall: "Basic Automotive Service," (FS); "How the Automobile Works," (FS); Georgia: Transportation, "Testing Battery Gravity," (ST); "Performing Light Load Test on Battery," (ST); "Testing the Battery with Cell Probes," (ST); "Testing a Battery for Capacity," (ST); "Cleaning the Battery," (ST); "Charging a Battery," (ST); Georgia: Auto Mechanics, "Test and Service Storage Battery," (ST)	Crouse and Anglin: The Auto Book; Wetzel: Automotive Diagnosis and Tune-Up	Georgia: Transportation Cluster, Unit TSB-1; Georgia: Auto Mechanics, Unit 201-4; Oklahoma: Auto Mechanics II

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
C-01 Reading a rule		Feirer and Hutchings: Carpentry and Building Construction; Wagner: Modern Carpentry	Georgia: Construction Cluster, Units ML-1a, 2
C-02 Reading a scale		Feirer and Hutchings: Carpentry and Building Construction; Wagner: Modern Carpentry	Georgia: Construction Cluster, Unit BR-1
C-03 Reading orthographic drawings		Feirer and Hutchings: Carpentry and Building Construction; Wagner: Modern Carpentry	Georgia: Construction Cluster, Unit BR-2
C-04 Identifying elevations		Feirer and Hutchings: Carpentry and Building Construction; Wagner: Modern Carpentry	Georgia: Construction Cluster, Unit BR-3
C-05 Identifying symbols		Feirer and Hutchings: Carpentry and Building Construction; Wagner: Modern Carpentry	Georgia: Construction Cluster, Units BR-4 - BR-6
C-06 Using hand tools (tooth cutting, edge cutting, boring, assembly and smoothing tools)	Bergwall: "Woodworking Hand Tools Explained," (FS)	Dahl and Wilson: Cabinet Making and Millwork; Groneman and Glazener: Technical Woodworking; Jones: Basic Cabinetmaking; Lewis: Safety for Carpenters and Woodworkers; McDonnell and Kaumeheiwa: The Use of Hand Woodworking Tools	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
C-07 Using measuring tools		Dahl and Wilson: Cabinet Making and Millwork; Lewis: Safety for Carpenters and Woodworkers; McDonnell and Kaumeheiwa: The Use of Hand Woodworking Tools	
C-08 Using fasteners (nails, screws, glue)		Dahl and Wilson: Cabinet Making and Millwork; Lewis: Safety for Carpenters and Woodworkers	
C-09 Using portable power tools (saws, drills, router and sanders)	Career Aids: "Woodworking Power Tools Series," (FS)	Dahl and Wilson: Cabinet Making and Millwork; Drake: Everyone's Book of Hand and Small Powered Tools	
C-10 Surfacing stock, jointing edges and dressing lumber to thickness	Career Aids: "Woodworking Power Tool Series," (FS); "Woodworking Machine Operations Explained," (FS); Prentice-Hall: "Woodworking: Power Tools," (FS)	Dahl and Wilson: Cabinet Making and Millwork; Jones: Basic Cabinetmaking; Lewis: Safety for Carpenters and Woodworkers	
C-11 Ripping stock	Bergwall: "Woodworking Machine Operations Explained," (FS); Prentice-Hall: "Woodworking: Power Tools," (FS); "Woodworking: Power Saws," (FS)	Groneman and Glazener: Technical Woodworking	
C-12 Cutting stock to length		Dahl and Wilson: Cabinet Making and Millwork; Lewis: Safety for Carpenters and Woodworkers	

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TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audiovisuals	Textbooks	Student Materials
C-12 Cutting stock to length		Dahl and Wilson: Cabinet Making and Millwork; Lewis: Safety for Carpenters and Woodworkers	
C-13 Using the band saw and scroll saw	Bergwall: "Woodworking Machine Operations Explained," (FS)	Lewis: Safety for Carpenters and Woodworkers	
C-14 Using the shaper and overarm router	Bergwall: "Woodworking Machine Operations Explained," (FS)	Lewis: Safety for Carpenters and Woodworkers	
C-15 Making wood joints		Dahl and Wilson: Cabinet Making and Millwork; Lewis: Safety for Carpenters and Woodworkers	
C-16 Using the wood lathe to turn stock	Bergwall: "Woodworking Machine Operations Explained," (FS)	Lewis: Safety for Carpenters and Woodworkers	
C-17 Boring holes and cutting plugs	Bergwall: "Woodworking Machine Operations Explained," (FS)	Lewis: Safety for Carpenters and Woodworkers	
C-18 Sanding flat surfaces	Bergwall: "Woodworking Explained: Building a Better Bookshelf," (FS)	Lewis: Safety for Carpenters and Woodworkers	

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AAVIM	Slide/tapes
Automated Training, Inc.	Filmstrips, 16mm cartridge
Bennett Publishing Company	Transparencies
Bergwall Productions, Inc.	Filmstrips
Career Aids, Inc.	Filmstrips
Carrier Corporation	Slide/tapes
DCA Educational Products	Transparencies, 8mm film loops
Georgia Department of Education	Slide/tapes
Hobar Publications	Slide/tapes
Long Filmslide Service	Filmstrips
Prentice-Hall Media	Filmstrips
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AAVIM	Slides/tapes and transparencies
A.J. Nystrom and Co.	Transparencies
Animated Electronic Films	Super 8mm loop
Association Films, Inc.	16mm reel
Audio Active	Tapes
Automated Training, Inc.	Sound filmstrips 16 mm snap-in cartridge
Bailey-Film Associates	Super 8mm loop
Bergwall Productions, Inc.	Filmstrips
Bobbs-Merrill	Slides/tapes
Career Aids, Inc.	Filmstrips
CCM School Materials, Inc.	Transparencies
CENCO Education Aids	8mm loop/transparencies
Classroom Film Distributors, Inc.	16mm films
Colonial Films	16mm films Sound filmstrips
Coronet Films	16mm reel
Creative Visuals	Transparencies
Curriculum Materials Corp.	Filmstrips
Daystar Audio Visual	Sound filmstrips
DCA Educational Products	Sound filmstrips
Dorsett	Sound filmstrips
Encyclopedia Britannica Education Corp.	Sound filmstrips
Eye Gate House, Inc.	Sound filmstrips
GAF Corporation Reprographic Products	Transparencies
George F. Cram Company, Inc.	Transparencies
Hobar Publications	Transparencies

Indiana University Audio Visual Center	16mm reel
Instructional Materials Laboratory, University of Missouri	Slides/tapes
Jam Handy School Service, Inc.	Filmstrips/super 8mm loop
Long filmslide Service	Filmstrips
MAVCC	Transparencies
McGraw-Hill Films	Filmstrips/transparencies
Minnesota Mining and Manufacturing Co.	Transparencies
NASCO	Filmstrips/transparencies
National Film Board of Canada	Sound filmstrips
National Training Aids, Inc.	Slide sets
Popular Science Publishing Co.	Filmstrips/transparencies
Prentice-Hall Media	Filmstrips
Rand McNally and Co.	8mm loop
Robert Brady Co.	Sound filmstrips
Schoolmasters Science	8mm loop
Serina Press	16mm reel
Singer Care Systems	Filmstrips
Society for Visual Education, Inc.	Sound filmstrips
Stansi Scientific Division	Transparencies
Sterling Educational Films	8mm loop
3 M Company	Transparencies
Tweedy Transparencies	Transparencies
U.S. Department of Agriculture	Sound filmstrips
U.S. National Audiovisual Center	16mm films
United Transparencies, Inc.	Transparencies

Universal Education and Visual Arts	16mm reel
University of Illinois	Sound filmstrips
University of Illinois Vocational/Agriculture Service	Sound filmstrips
Vocational Education Media Center, Clemson University	Transparencies
Westinghouse	Filmstrips
Whirlpool	Filmstrips

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Individualized Instruction

Instructional Materials Laboratory, University of Missouri, Columbia	Study Guides
Mid-America Vocational Curriculum Consortium	Instructional Units
Oklahoma State Department of Vocational and Technical Education	Instructional Units

Curriculum

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RESOURCE ADDRESSES

AAVIM
120 Engineering Center
Athens, GA 30602

AC-Delco Division
General Motors Corp.
400 Renaissance Center
Detroit, MI 48243

Airesearch
P.O. Box 92930
Los Angeles, CA 90009

A.J. Nystrom and Company
3333 Elston Avenue
Chicago, IL 60618

Albertson and Company, Inc.
Sioux City, IA 51102

Alemite Division
Stewart-Warner Corp.
1826 W. Diversey Parkway
Chicago, IL 60614

Allen Electric and Equipment
Co.
2101 N. Pitcher Street
Kalamazoo, MI 49002

The Aluminum Association, Inc.
818 Connecticut Ave., N.W.
Washington, DC 20006

American Bosch
3664 Main Street
Springfield, MA 01107

American Technical Society
5608 Stony Island Avenue
Chicago, IL 60637

American Welding Society
2501 N.W. 7th Street
Miami, FL 33125

Ammoco Tools, Inc.
2100 Commonwealth Avenue
North Chicago, IL 60064

Animated Electronic Films
P.O. Box 2036
Eads Station
Arlington, VA 22202

Arvin Industries, Inc.
Automotive Aftermarket Div.
Columbus, IN 47201

Association Films, Inc.
600 Madison Avenue
New York, NY 10022

Audio Active, Inc.
Jonesboro, AR 72401

Automated Training, Inc.
1401 S. Mint Street
Box 34707
Charolette, NC 28234

Auto Specialties Manufacturing
Company
St. Joseph, MI 49085

Auto-Lite Division
Ford Motor Company
1122 Millidge Drive
East Point, GA 30344

Auto-Test, Inc.
411 West 8th Street
Neillsville, WI 54456

Bailey Film Associates
11559 Santa Monica Blvd.
West Los Angeles, CA 90025

Balcrank Products
Wheelabrator-Frye, Inc.
400 South Byrkit Avenue
Mishawaks, IN 46544

Bear Manufacturing Corporation
2830 Fifth Street
Rock Island, IL 61201

Bendix Automotive
1217 S. Walnut Street
South Bend, IN 46620

Bennett Publishing Company
809 W. Detweiller Drive
Department E 81
Peoria, IL 61615

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NY 11530

Black and Decker Manufacturing
Company
Towson, MD 21204

Blackhawk Manufacturing Co.
Applied Power Industries, Inc.
Box 8720
Milwaukee, WI 53227

Bobbs-Merrill Educational
Publishing
4300 West 62nd Street
P.O. Box 7080
Indianapolis, IN 46206

Brick Institute of America
Region Nine Office
100 Northcreek-Suite 280
Atlanta, GA 30327

California State Department of
Education
Bureau of Industrial Education
721 Capitol Mall
Sacramento, CA 95814

Career Aids, Inc.
8950 Lurline Avenue
Dept. T 76
Chatsworth, CA 91311

Carrier Corporation
Mingledorff Company
P.O. Box 13031
Atlanta, GA 30321

Carter Carburetor Division
AFC Industries, Inc.
Educational Aids Department
P.O. Box 16092
Clayton, MO 63105

CCM School Materials, Inc.
2124 West 82nd Place
Chicago, IL 60620

CENCO Educational Aids
2600 S. Kostner Avenue
Chicago, IL 60623

CRC Chemicals
Division of C.J. Webb, Inc.
Limekiln Pike
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Dresher, PA 19025

Champion Spark Plug Company
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Charles A. Bennett Co., Inc.
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Chemetron Corporation
Arc Products Division
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Atlanta, GA 30315

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Chilton Way
Radnor, PA 19089

Chicago Rawhide Manufacturing
Company
900 N. State Street
Elgin, IL 60120

Classroom Film Distributors,
Inc.
5610 Hollywood Blvd.
Los Angeles, CA 90028

Clemson University
Clemson, SC 29631

Clymer Publications
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P.O. Box 20
Arelta, CA 91331

Coats Company, Inc.
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La Vergne, TN 37086

Colonial Films
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Atlanta, GA 30308

Continuing Education
Publications
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Portland, OR 97207

Copeland: Copeland Corporation
Sidney, OH 45365

Coronet Films
65 E. South Water Street
Chicago, IL 60601

Creative Visuals
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Big Spring, TX 79720

Curriculum Materials Corporation
1319 Vine Street
Philadelphia, PA 19109

Dana Parts Corporation
P.O. Box 500
Hagerstown, IN 47346

Daystar Audio Visual
3 Inverness Drive East
Englewood, CO 80112

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424 Valley Road
Warrington, PA 18976

DCE Publications
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Portland, OR 97207

Delmar Publishers
50 Wolf Road
Albany, NY 12205

Department of Industrial Education
University of Maryland
College Park, MD 20742

Division of Vocational Education
Alabama State Department of Education
Link Education Laboratory
Montgomery, AL 36111

Doolco, Inc.
2016 Canton
Dallas, TX 75226

Dorsett Educational Systems, Inc.
P.O. Box 1226
Norman, OK 73070

Dover Publications
180 Varick Street
New York, NY 10014

Duxbury Press
North Scituate, MA 02060

Echlin Manufacturing Company
Branford, CT 06405

E. Edelmann and Company
Chicago, IL 60647

Educational Methods
Division of Development
Systems Corporation
Chicago, IL 60690

EIS Corporation
Middlefield, CT 06455

Eye Gate House, Inc.
146-01 Archer Avenue
Jamaica, NY 11435

Encyclopedia Britannica Educational Corporation
425 N. Michigan Avenue
Chicago, IL 60611

Fel-Pro Incorporated
Skokie, IL 60076

Ford Service Publications
P.O. Box 07150
Detroit, MI 48207

Fox Valley Instrument Co.
Sheboygan, MI 49721

Fram
Providence, RI 02916

Gabriel Division
Maremount Corporation
1283 Murfreesboro Road
Nashville, TN 37217

GAF Corporation Reprographic Products
140 West 51st Street
New York, NY 10020

Garden Way Publishing
Charolotte, VT 05445

Gates Rubber Company
999 South Broadway
Denver, CO 80217

George F. Cram Company, Inc.
School and Library Division
P.O. Box 426
Indianapolis, IN 46206

Georgia Office of Vocational
Education
Georgia Department of Education
Atlanta, GA 30334

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123 W. Tart Drive
South Holland, IL 60473

Goodyear Tire and Rubber Co.
Akron, OH 44309

Gould Engine Parts Division
St. Paul, MN 55101

Graham Research, Inc.
Minneapolis, MN 55418

Gregg/McGraw-Hill
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Norcross, GA 30091

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Raybestos Manhattan, Inc.
P.O. Box 9140
Bridgeport, CT 06603

Hampden Engineering Corporation
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East Longmeadow, MA 01028

Harrison Radiator Division
General Motors Corporation
Lockport, NY 14094

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Hastings, MI 49058

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Department of the Army
Washington, DC 20310

Henk Newenhouse/Novo
1825 Willow Road
Northfield, IL 60093

Herbrand, Kelsey Hayes Tool
Division
Orangeburg, SC 29115

Hobar Publications
1234 Tiller Lane
St. Paul, MN 55112

Hobart Brothers Company
Box DM-553
Troy, OH 45373

Holset
Division of Lucas
P.O. Box 24030
Jacksonville, FL 32217

Holt, Rinehart and Winston
383 Madison Avenue
New York, NY 10017

Howard W. Sams and Co., Inc.
4300 W. 62nd Street
Indianapolis, IN 46206

Hunter Engineering Co.
1350 Hunter Drive
Bridgton, MS 63044

Indiana University Audio
Visual Center
Field Services Department
Bloomington, IL 47401

Ingersol Rand/Proto Tool Co.
2309 Santa Fe Avenue
Los Angeles, CA 90058

Instructional Materials
Laboratory
10 Industrial Education
Building
University of Missouri-
Columbia
Columbia, MO 65221

Jam Handy School Service, Inc.
2781 East Grand Blvd.
Detroit, MI 48221

John Bean Division
FMC Corporation
Lansing, MI 48900

John Wiley and Sons, Inc.
Eastern Distribution Center
1 Wiley Drive
Somerset, NJ 08873

Kal-Equip Company
411 Washington Street
Otsego, MI 49078

K-D Manufacturing Company
Hempland Road
Lancaster, PA 17604

Kelsey Products Division
Kelsey-Hays Company
38481 Huron River Drive
Romulus, MI 48174

Kem Manufacturing Company, Inc.
Fair Lawn, NJ 07410

Lincoln Electric Co.
Cleveland, OH 44117

Lockhead Products
Wagner Electric Corporation
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St. Louis, MO 63100

Long Filmslide Service
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El Ceritto, CA 94530

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Santa Monica, CA 90404

Mac Tools, Inc.
Washington Court House,
OH 43160

Marquette Corporation
307 East Hennepin Avenue
Minneapolis, MN 55414

MAVCC
1515 West Sixth Avenue
Stillwater, OK 74074

McGraw-Hill Book Company
330 West 42nd Street
New York, NY 10036

McKnight Publishing Co.
Box 2854
Bloomington, IL 61701

McQuary-Norris Manufacturing
Company
St. Louis, MO 61300

Metalbestos Products
P.O. Box 137
Belmont, CA 94002

Mid-America Vocational
Curriculum Consortium
1515 West Sixth Avenue
Stillwater, OK 74074

Miller Electric Mfg. Co.
P.O. Box 1079
Appleton, WI 54912

Milwaukee Hydraulic Products
Corporation
Milwaukee, WI 53214

Minnesota Mining and
Manufacturing Co.
Medical Film Laboratory
3 M Center
St. Paul, MN 55101

Mitchell Manuals, Inc.
P.O. Box 80427
San Diego, CA 92138

Monticello Books
Lake Zurich, IL 60047

Moog Industries
Box 7224
St. Louis, MO 63177

Morris Tools
724 Penryn Road
Manheim, PA 17545

Motor
1970 Broadway
New York, NY 10016

Motorola, Inc.
1299 E. Algonquin Road
Schaumburg, IL 60196

NAPA
Distribution Center
P.O. Box 2000
Norcross, GA 30091

NASCO
Ft. Atkinson, WI 53538

National Film Board of Canada
1251 Avenue of the Americas
New York, NY 10020

National Fire Protection
Association
470 Atlantic Avenue
Boston, MA 02210

National Training Aids, Inc.
Manual Division "M"
P.O. Box 565
Norcross, GA 30091

Nebraska Department of Education
Division of Vocational Education
2333 S. Tenth Street
Lincoln, NE 68508

Neway Sales, Inc.
Corunna, MI 48817

New Hampshire Facilitator Center
80 South Main Street
Concord, NH 03301

New Jersey Vocational-Technical Curriculum Laboratory
Rutgers-The State University
4103 Kilmer Campus
New Brunswick, NJ 08903

New York State Education Dept.
Bureau of Secondary Curriculum Development
Albany, NY 12224

Nooger and Neville, Inc.
15 Maiden Lane
New York, NY 10038

Office of Career and Adult Education
State Department of Education
Jefferson City, MO 65101

Oklahoma State Department of Vocational and Technical Education
1515 W. Sixth Street
Stillwater, OK 74074

Orange County Career Development Program
410 Woods Avenue
Orlando, FL 32805

Oregon Board of Education
942 Lancaster Drive, N.E.
Salem, OR 97310

Owatonna Tool Company
P.O. Box 268
Owatonna, MN 55060

P & C Hand Tool Company
P.O. Box 22066
Portland, OR 93222

Pennzoil
Oil City, PA 16301

Popular Science Publishing Company
Audio Visual Division
355 Lexington Avenue
New York, NY 10017

Prentice-Hall, Inc.
Englewood Cliffs, NJ 07632

Prentice-Hall Media
ServCode XF
150 White Plains Road
Tarrytown, NY 10519

Prestolite
P.O. Box 963
300 City Park Avenue
Toledo, OH 43601

Proto Tool Division
Ingersol Rand Corporation
3900 Wesley Terrace
Schiller Park, IL 60176

Quaker State Oil Refining Corp.
Oil City, PA 16301

Rand McNally and Company
405 Park Avenue
New York, NY 10022

Raybestos Division
Raybestos Manhattan, Inc.
Bridgeport, CT 06603

Reader's Service Department
Iron Age
One Decker Square
Bala-Cynwd, PA 19004

Regnery Publishing Company
114 West Illinois Street
Chicago, IL 60610

Reston Publishing Company
11480 Sunset Hills Road
Reston, VA 22090

Reynolds Metals Company
Richmond, VA 23261
Sales Office in Georgia
62 Perimeter Center East
Atlanta, GA 30346

RMI Film Productions
701 Westport Road
Kansas City, MO 64111

Robert Brady Co.
150 White Plains Road
Tarrytown, NY 10591

Robertshaw Controls Company
P.O. Box 400
2318 Kingston Pike
Knoxville, TN 37901

Rockwell International
Power Tool Division
6263 Poplar Avenue
Memphis, TN 37901

Rutgers-The State University
Building 4103
Kilmer Campus
New Brunswick, NJ 08903

Sanford Research Project
Sanford, NC 27330

Schoolmasters Science
745 State Circle
Ann Arbor, MI 48104

School Media Associates
2620 Caladium Drive, N.E.
Atlanta, GA 30345

Serina Press
70 Kennedy Street
Alexandria, VA 22305

Shell Film Library
1433 Sadlier Circle W. Drive
Indianapolis, IN 46239

Singer Career Systems
80 Commerce Drive
Rochester, NY 14623

Silux, Inc.
2901 Floyd Boulevard
Sioux City, IA 51102

S.K. Wayne Tool Company
Chicago, IL 60604

Smith Welding Equipment
Division of Tescom
Corporation
2600 Niagra Lane North
Minneapolis, MS 55441

Snap-On Tools Corporation
8028 28th Avenue
Kenosha, WI 53140

Society for Visual Education, Inc.
Division of Singer Co.
1345 Diversey Parkway
Chicago, IL 60614

Square D Company
Executive Plaza
Palatine, FL 60067

Standard Electric Time Company
89 Logan Street
Springfield, MA 01101

Standard Motor Products, Inc.
37-18 Northern Boulevard
Long Island City, NY 11101

Standard Thomson Corp.
152 Grove Street
Waltham, MA 02154

Stansi Scientific Division
1231 North Honore Street
Chicago, IL 60622

Stant Manufacturing Co., Inc.
Connersville, IN 47331

Sterling Educational Films
241 E 34th Street
New York, NY 10016

Stewart-Warner Corporation
Alemite and Instrument
Division
1826 Diversey Parkway
Chicago, IL 60614

Sun Electric Corporation
Harlem and Avondale
Chicago, IL 60631

Sunnen Products Company
St. Louis, MO 63143

Superintendent of Documents
U.S. Government Printing
Office
Washington, DC 20402

Theodore Audel and Company
Howard W. Sams and Co., Inc.
4300 West 62nd Street
Indianapolis, IN 46206

3 M Company
Visual Products Division
St. Paul, MN 55101

TRW, Inc.
Replacement Division
8001 E. Pleasant Valley Road
Cleveland, OH 44131

Tweedy Transparencies
208 Hollywood Avenue
East Orange, NJ 07018

Union Carbide Corporation
270 Park Avenue
New York, NY 10017

United States National Audio-
visual Center
National Archives and Records
Service
Washington, DC 20409

United Transparencies, Inc.
P.O. Box 688
Binghamtom, NY 13902

Universal Education and Visual
Arts
100 Visual City Plaza
Universal City, CA 91608

University of Georgia
College of Education
Division of Vocational Education
Vocational Education Materials
Center
Green Street
Athens, GA 30602

University of Illinois
Visual Aids Service
1325 S. Oak
Champaign, IL 61820

University of Illinois
Vocational Agriculture Service
434 Mumford Hall
Urbana, IL 61801

University of Missouri-
Columbia
10 Industrial Education Bldg.
Columbia, MO 65211

University of Texas
Division of Extension
Instructional Materials
Service
Austin, TX 78712

U.S. Department of Agriculture
Motion Pictures Service
Room 1850, South Building
Washington, DC 20250

U.S. Department of Labor
Bureau of Apprenticeship and
Training
Washington, DC 20210

U.S. National Audiovisual
Center
General Services Administration
Washington, DC 20409

Valvoline Oil Company
Division of Ashland Oil Co.
Ashland, KY 41101

Victor Equipment Company
Manufacturing Plant
Airport Road
Denton, TX 76201

Vocational Education Media
Center
Clemson University
Clemson, SC 29631

Vocational Education Materials
Center
University of Georgia
Green Street
Athens, GA 30602

Vocational Instructional
Services
Texas A & M University
College Station, TX 77843

Vocational-Technical Curriculum
Laboratory
Rutgers-The State University
Building 4103
Kilmer Campus
New Brunswick, NJ 08903

Walker Manufacturing Company
1201 Michigan Boulevard
Racine, WI 53402

Weaver Division Dura Corp.
2171 South 9th Street
Springfield, IL 62705

Westinghouse Corporation
P.O. Box 4022
Elyria, OH 44036

Whirlpool Corporation
Service Training Department
Benton Harbor, MI 49022

Whirlpool Corporation
Technical Information Center
Benton Harbor, MI 49022

Wisconsin Vocational Studies
Center
University of Wisconsin -
Madison
964 Educational Services
Building
1025 West Johnson Street
Madison, WI 49002

APPENDIX B

Special Needs

WORKING WITH SPECIAL NEEDS STUDENTS*

Introduction

Special needs population students are those who are designated as handicapped or disadvantaged. The 1976 vocational education amendments define handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In those same amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special needs population students be given an opportunity to function in regular vocational education programs (Essentially, this is what is meant by the term mainstreaming.). This section provides information on how such students are identified and how they can be mainstreamed into regular vocational education environments.

Figure One presents a conceptual model depicting various activities of the process in identifying and mainstreaming special needs students in vocational education. These activities

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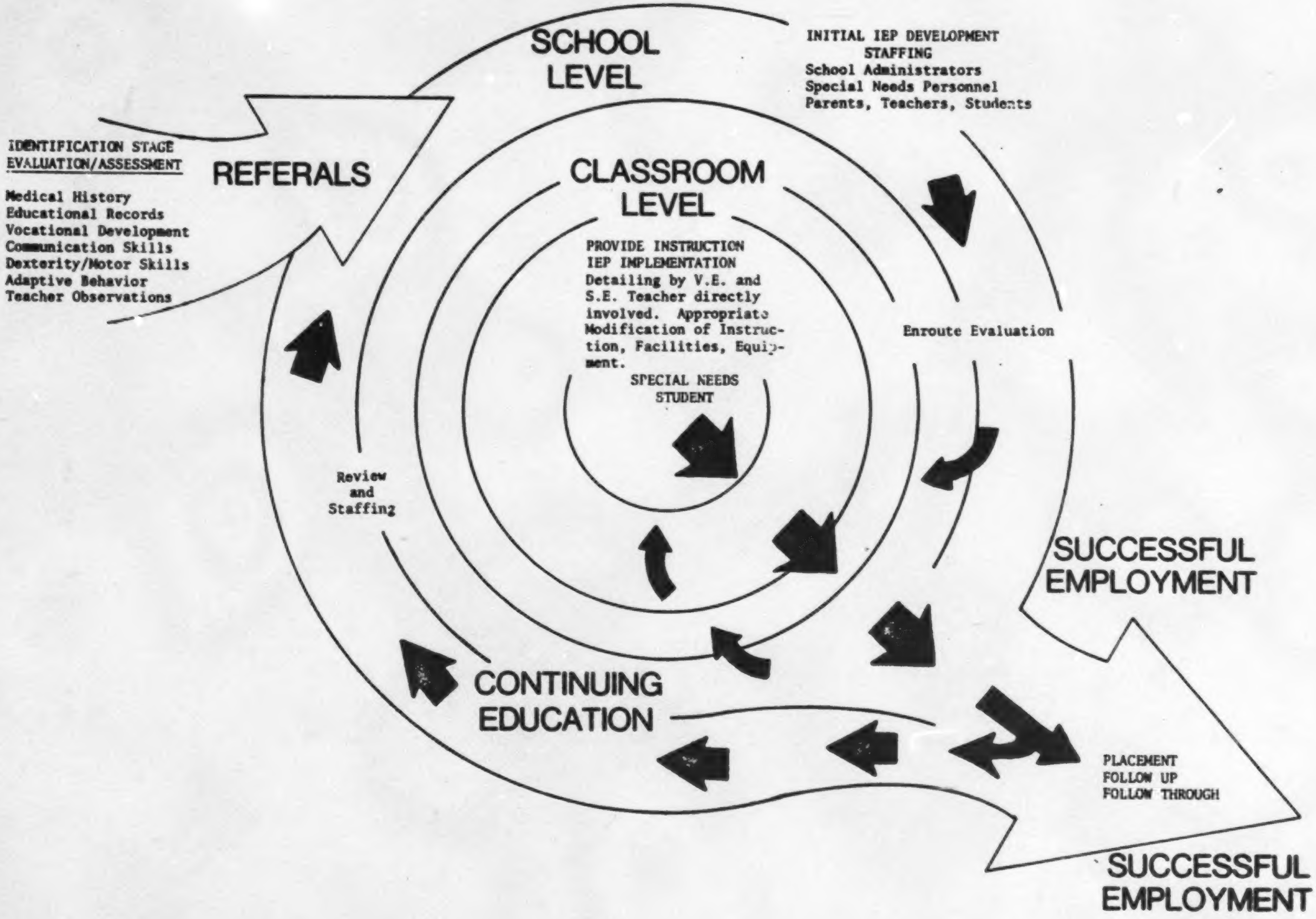
*The project director wishes to thank Mrs. Ann Lary, State Department of Education staff and Mrs. Rhonda Packer, VEMC staff, for their careful review of this section and for their suggestions that improved the overall value of this paper. Appreciation is also extended to Ray Butler for his patient work in reviewing and sorting available resources.

THE CONCEPT OF MAINSTREAMING


SCHOOL LEVEL
INITIAL IEP DEVELOPMENT
STAFFING
School Administrators
Special Needs Personnel
Parents, Teachers, Students
IDENTIFICATION STAGE
EVALUATION/ASSESSMENT
Medical History
Educational Records
Vocational Development
Communication Skills
Dexterity/Motor Skills
Adaptive Behavior
Teacher Observations
REFERALS
CLASSROOM LEVEL
PROVIDE INSTRUCTION
IEP IMPLEMENTATION
Detailing by V.E. and S.E. Teacher directly involved. Appropriate Modification of Instruction, Facilities, Equipment.
SPECIAL NEEDS STUDENT
Enroute Evaluation
Review and Staffing
SUCCESSFUL EMPLOYMENT
CONTINUING EDUCATION
PLACEMENT
FOLLOW UP
FOLLOW THROUGH
SUCCESSFUL EMPLOYMENT

are conducted at three levels: the community level, the school level (Career Development Center) and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification of the Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the community level. This evaluation process consists of collecting and assessing the following data for each student:

-Medical History
-Educational Records
-Vocational Development
-Communication Skills
-Dexterity/Motor Skills
-Adaptive Behavior
-Teacher Observations

When this procedure has been completed, the community personnel refers the student to the appropriate school level personnel. As a part of the referral and school intake process, an Individualized Educational Plan should be initiated.

> The Individualized Educational Plan (IEP) is exactly what its name implies--a plan for the education of a specific individual. The base content of the IEP is outlined in Public Law 94-142. According to that outline, the IEP must include at least the following information: (a) student's present level of functioning, (b) his/her long range instructional objectives, (c) his/her short-range instructional objectives and finally, (d) some criteria to determine that those objectives have been achieved.

Development of the Individual Education Plan

It would be very difficult to anticipate the exact kind or type of special needs students one might find in an Industrial Maintenance program at any one time. The terms disadvantaged and handicapped are really "catch-all" terms that indicate a wide assortment of problems that might occur in a student representing one of these populations. In addition to the lack of a specific definition and the fact that the typical vocational instructor has had very little preparation in working with these students, it becomes clear that you will need a basic plan to use in meeting their occupational preparation needs. The following steps can serve as your basic planning procedure for mainstreaming a special needs population student into your curriculum.

The first step occurs after you have been notified that a special needs student can profit from being in your vocational program. When you have received that notification, you should contact your coordinator of student personnel services and ask for a detailed report of the student's assessed status. Note the word assessed; it is critical. Through a formal assessment status, appropriate school personnel and community should have identified the student's strengths and weaknesses as well as the specific handicapping conditions. After you have received the assessment information and understand it you are ready for Step Two.

Step Two, developing (or completing) the vocational aspects of the Individual Education Plan-IEP, is usually performed for handicapped students only; however, it has just as much merit for the disadvantaged. The IEP is a very useful tool. It should be considered the description of what you expect that student to be able to do when he or she completes your course and how you will provide the learning experiences to assure that those expected outcomes will be achieved. Be sure that you keep this IEP in a convenient place and use it.

The IEP is usually developed through group activities called staffings. Staffings may be held as often as needed and can be used to modify the IEP as the student moves through the program. When a student is about to be mainstreamed into your curriculum, you must become involved in the staffing sessions that will develop the vocational aspects of the IEP. IT IS YOUR RIGHT AND YOUR DUTY, therefore, your being present during the staffings is imperative. The special education personnel can present the student's interests, strengths and limitations. However, only you, the vocational instructor, can relate these to your program. This means that the final statement of the job (DOT) and the task level (short term) objectives are primarily defined by you the vocational instructor.

In Step Three the IEP will first be used to suggest how the curriculum and/or the facilities can be modified to accommodate the special needs population student. Modifying the curriculum means that in most cases special adjustments will have to be made in the student materials and that special instructional strategies will need to be developed. When you say modify the curriculum you are not suggesting that the content be "watered down" - you are proposing alternate ways to teach the proper/required content. REMEMBER! ALL VOCATIONAL EDUCATION PROGRAMS ARE BASED ON REAL JOBS THAT HAVE THEIR OWN TASKS AND STANDARDS. AS FAR AS YOU ARE CONCERNED, YOU HAVE NO POWER TO CHANGE THESE. YOU ALSO CANNOT SUCCESSFULLY CREATE A WHOLE NEW JOB.

Modification of facilities and equipment is a concern when working with the phyically handicapped. Be reminded that by law your school building must already meet requirements of accessibility to all handicapped persons--especially those who are blind or are confined to wheelchairs. Your chief concern is to be sure that your classroom and laboratory will allow the handicapped students to be comfortable and above all to learn. You will also need to make certain modifications that will enable handicapped students to properly and safely use the "tools and equipment of the trade". It is foolish to think that you would have a ready answer for all or any particular one of these physical handicaps--call on the experts. Vocational rehabilitation counselors and other staff have been concentrating on these problems for many years. They should be able to offer a number of positive suggestions. A combination of VR experience and instructor creativity can and has produced outstanding results.

As we think about curriculum modification it would help to review some general learning needs of this population.

> The educationally mentally retarded will constitute a major population now entering vocational education. The key concept to remember in modifying the curriculum for this population is that they require much more detail in order to learn and they require a great deal more practice time. All curriculum modifications for these groups should be made by detailing each task or objective into its smallest parts and by providing for more and more practice.
>
> The hearing and visually impaired can be accommodated by common sense and the use of supporting resource personnel. Neither of these groups reads well or learns from reading as a primary mode. This should be accounted for in modifying the curriculum, i.e., larger print, brail and recordings for the blind and captions on visual materials, seating arrangements, use of notes from a classmate, lower reading level textbooks, oral testing and total communications for the deaf.

The orthopedically handicapped usually require attention to facilities and equipment. Beyond that, their learning needs are as varied as those of the normal population. Remember, some of these individuals will actually be highly gifted in their chosen field. Their major needs will be psychological and coping with the school environment.

The disadvantaged are physically and mentally capable of learning, but their background has not allowed them to fully develop the discipline and cognitive skills (i.e., vocabulary, math, etc.) required to master occupational preparation courses. They have also developed an anti-school attitude that complicate many efforts to modify the curriculum for them. Usually their success in the vocational program is contingent on either a good prevocational program or a supporting academic program.

Step Four requires that instructional strategies be selected. These strategies may be many and should be varied. They should reflect the best learning technique for a given student and his or her chosen occupation. Some examples of instructional strategies are discussed below.

Teacher demonstration: Simply show the student how the job is to be done in clear distinct steps.

Peer demonstration: This technique allows the instructor to use one of the advanced students to demonstrate a particular task in a step by step fashion. It is a flexible system. For example, you can use peer demonstration to show each task step while you explain them to the students. When working with the mentally retarded, you will never have enough time to demonstrate a task as often as they may need to see it. In such situations, the well prepared advanced student can perform and explain the same demonstration several times.

Shadowing: Shadowing can be used in conjunction with demonstrations. By shadowing, the student is allowed to do exactly what the demonstrator does. This allows the student to learn in a see and do fashion. The student may shadow the instructor, an advanced peer or in some instances the worker on the job.

Job site visits: Job site visits offer the student an opportunity to see the work being done in its natural location. Students can develop a worker identify a realistic view of how the tools, equipment and materials are brought together to produce the product.

Work group or team: By being a part of a work team, the student can learn the various roles in an occupation as having the opportunity to practice specific sets of skills under the tutelage of peers.

Individualized instruction: Appropriately prepared or adjusted individualized instruction is a big help in managing a class that contains a mixture of special needs population students and "norm group" students. Individualized instruction, no matter what the source, will require much developmental input from the instructor. In most all cases, however, the results are worth the effort.

Media: Many of the special needs populations require mediated instruction (i.e., hearing and visually impaired), however, the use of appropriate media enhances learning for all students. Media can range from a line drawing in an instructional module, to a video tape, to posters and charts. It can be instructor made or commercial. All that matters is that it exactly links to the objective.

Project Method: The value in using projects with special needs population students is that they help them mentally and physically unify all the parts into a uniform whole. Because of the detail required for them to learn, they need learning activities that relate all of the parts to the whole. The development of a product through an assigned project is an ideal integrating experience.

Simulations: Simulations meet a variety of instructional needs. One of the more important with special needs population students is providing the opportunity to develop proper safety concepts before actually working with the "live" equipment that could be dangerous to a careless student.

Role playing: Role playing is a part of several other instructional strategies. On its own, it is a very good procedure for developing the attitudes and values required of a successful worker-i.e., a sense of responsibility, the ability to take orders and follow directions, interpersonal skills and so on. It is a way to concentrate on developing good work habits and positive attitudes.

Peer instruction: Like peer demonstrations, peer instruction is able to multiply the instructor's available time. This allows individual students with specific needs to have more assistance. Peer instruction has values beyond expanding time; it is an excellent approach to learning. In almost every situation, both the peer teacher and the peer student profit from the exchange. In operation peer instruction is simply a matter of preparing and allowing one of the advanced students to teach small groups certain segments of a course.

Team teaching: As we have already noted, some special needs populations require a combination of vocational and special education presented in harmony. A team approach is the only way to meet that need. For team teaching to be effective, clarification of student needs (as defined by the IEP) and careful planning will be required.

Peer apprenticeships: The peer apprenticeship is an ideal way to induct the new special needs population student into the curriculum. By serving as the apprentice to an advanced student, the special needs population student can become climatized to the laboratory/shop and can begin to learn the tools, equipment and materials of the program. The shadow technique can also be added to increase hands-on learning.

Assessment and feedback: Student learning can be improved by frequently assessing students' skills and feeding back their strengths and weaknesses. Through a process of positive feedback, the student can be moved gradually from where he or she is to the level of skill required.

These instructional strategies can be used independently or in various combinations. This brief list is meant only to provide you with some suggestions, there are no doubt many other techniques that could be used. The creative instructor will be constantly innovating to meet the needs of particular students.

Implementing the IEP

Step Five is a matter of putting the vocational aspects of the IEP into operation. The activation of the IEP initiates the student into the vocational education program and allows him or her to progress through the modified curriculum at his or her optium rate. There should be frequent assessment activities that indicate where the student is relative to the IEP objectives. If problems are detected, a staffing should be conducted to re-evaluate the IEP and continue the process in a fashion that is most beneficial to the student.

Step Six will take the student to his or her next logical step of either totally exiting the system or recycling into a continuing education mode. In most cases, the student will do some of both--getting a job and periodically accessing the continuing education component of the educational system to refine existing skills or to broaden his or her capacity.

The ultimate goal of all this effort is not employment-rather it is "successful employment". Successful employment implies that not only is the student placed in a job, but that the student is able to sustain himself or herself in a working environment over an extended period of time.

Evaluation

Evaluation of the student's program is a critical step. Through that process we not only help the current student, but we are able to gather information that will improve our potential to help students with similar difficulties in the future. A well rounded evaluation system should consist of the following activities:

-En-route evaluation (formative) to monitor the student's progress through the program.

-Summative evaluation upon completion of the program to determine job readiness.

-Follow-up after placement to determine if the student is successful on the job.

-Follow-through activities designed to identify any further training needed, which may be indicated by the follow-up procedure.

RESOURCES

In recent years, mainstreaming of special needs population students has been an area of great concern to vocational educators. The overall result of that concern is an abundance of well developed resource materials and a variety of personnel with special skills in working with these groups. In the space allowed by this curriculum guide, it would be impossible to present an adequate set of methods and procedures for solving the problems of students with special needs, but if the vocational education administrator and instructor will judiciously use the human and material resources listed here, much of the in-depth information required for the special and unique cases that will occur can be compiled from these sources.

Support Personnel or Systems

As was noted earlier, you the vocational instructor, simply do not have sufficient skills to work with special needs population students alone. There are too many different student problems to ever allow an instructor to deal with them all on a "come as you are" basis. For that reason, you must make yourself aware of the variety of support systems and personnel that are available to you and to the students. A few of these are listed here. These specialists can lead you to others on an as needed basis.

> County Health Department - Many of your special needs population students will need some medical and dental assistance. The county health facility is an excellent referral source for these problems.
>
> Special Education - Through local boards of education there are a variety of special education personnel available locally, regionally and from the State Department of Education. The vocational education administrator can obtain assistance from these specialists through the local superintendent's office.
>
> Project SERVE - Project SERVE is a statewide effort to acquire materials and to cultivate expertise in providing vocational education to disadvantaged. Project Serve can

be contacted by the area vocational-technical director or the vocational supervisor.

Vocational Rehabilitation - Vocational rehabilitation is a highly developed organization whose major focus is all dimensions (such as: diagnosing, training, job placement and counseling) of the handicapped population. Within that network is a vast pool of expertise. You can contact it through the area vocational rehabilitation counselor who calls on your school or through a designated school official such as the coordinator of student personnel services or Career Development Center personnel.

Office of Student Personnel Services - In the area vocational-technical school, this is the key group as far as students and student needs are concerned. They can provide a variety of services to you and to your students. Many of the contacts with community agencies have already been made by this group-that alone will save the instructor much time.

Career Development Center - Each area vocational-technical school has a Career Development Center designed to meet the very special needs of incoming disadvantaged and handicapped students. The CDC staff is available to assist the instructional staff with a wide range of services for the special needs student populations.

All of the resources and resource personnel listed here are a part of the team. The best results can be obtained by using as many of these people and their support systems as possible from the beginning. In some situations, you will miss a resource in the beginning or the student's needs change. When that occurs do not hesitate to call on the appropriate experts for additional help. As a matter of fact, the rule of thumb that has always been used in the "helping professions" is to go as far as you can, then refer. Do not hesitate to call for help. Most of these service groups are funded to support "your" student. If you do not use them, they fail in their mission and you fail in yours.

Related Materials

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APPENDIX C

Definition of Terms

DEFINITION OF TERMS

1. A/Vs-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)
2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.
3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting, the statement of a competency includes expected student outcomes in terms of knowledge, skills and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.
4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.
5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.
6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.
7. Curriculum Guide - A document containing the objectives, content, organization and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.
8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.
9. Duty - One of the distinct major activities involved in the work performed. A Composition of related tasks.
10. Exit Point - A pre-determined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.
11. "Hands-On" - Statement implying the student is physically involved in a learning activity.
12. Individualized Instruction (I.I.) - A system of instruction allowing a student to progress at his/her fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U.S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes occupational objectives.

22. Performance Guide - A series of steps arranged in a sequence which when completed may result in the performance of a task. Also called teaching steps.

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner underspecified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

b. Performance - The specific behavior expected of the learner is stated.

c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the student ability to operate, manipulate or perform a given task.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which he/she can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures, job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training material that generally covers one learning task and programmed on one unit sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

35. V'TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures and related data. Organized by a job structure or career ladder within a domain of interest.

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Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

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